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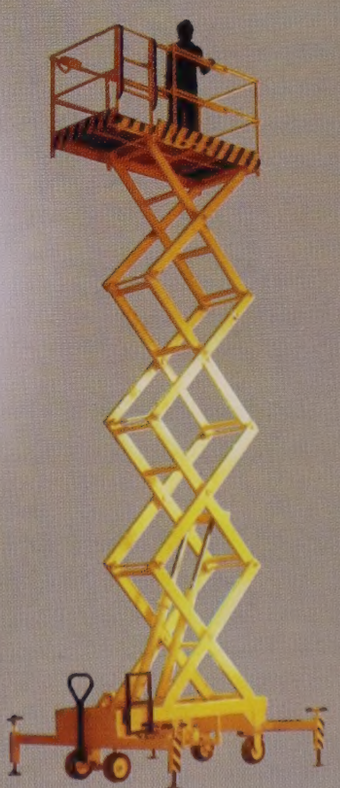

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INDIAN Food INDUSTRY
March–April 2002
Volume 21, Number 2

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DEPARTMENTS

On the cover: Photographs of ghee packages.

Courtesy : Indian Institute of Management, Ahmedabad

BON APPETIT

Winds of Change

Two Indian food scientists, Jammala Machaiah and Mrinal Pednekar, of the food science laboratory at Bhabha Atomic Research Centre, Bombay, have come up with a near cure for flatulence, by blasting guilty foodstuffs such as beans with *gamma* rays to knock out the offending chemicals that cause the problem. The paper based on the work was to be published by *Food Chemistry* and the news was splashed across the globe by New Scientist, Reuters, BBC and others.

Bacteria in the large intestine are responsible for the gases that cause flatulence, since they consume oligosaccharides and produce a mixture of methane and smelly sulphurous gases. Beans are most commonly blamed for this social embarrassment as 60 per cent of their carbohydrates are made up of oligosaccharides.

Using standard food treatment technology, they irradiated samples of mung beans, chickpeas, black-eyed beans and red kidney beans with low-intensity *gamma*-rays, before giving the beans their standard two day soak prior to cooking.

The scientists found that irradiation dramatically accelerated a reduction in oligosaccharides which occurs naturally in the soaking process.

We rarely see Indian food scientists attracting world media attention for their findings. From what these two women scientists could achieve, we can perhaps expect some winds of change.

Starfizz in Cola Wars

No Indian summer is hot enough without the kind of cola wars that are fought on its soil. And this summer, it is perhaps the hottest—what with the star power that has been unleashed on the consumer. While Pepsi has lined up the Big B, *et al* — Amitabh Bachchan, Sachin Tendulkar, Shahrukh Khan, Kareena Kapoor, Adnan Sami, etc, Coke has the Beautiful A and company — Aishwarya Rai, Aamir Khan, Sunil Gavaskar, Virender Sehwag, Bipasha Basu and others.

Though celebrity endorsement has been the mainstay of the commercials of cola majors, it has never reached such mad proportions. And we have many star icons from Bollywood and Cricketopia to play on the emotions and push up the sales.

Nestlé's Thumbs-down to Liberalization...for Once!

The disenchantment of Nestle India with the Indian Budget 2002-03 wasn't unexpected. The scrapping of the Milk and Milk Products Order (MMPO) in the Budget made Mr. Carlo M. Donati, the CMD of Nestle India, indignant. "Nestle is not a charitable organization. We invest because we want to collect (earn). We invest in the milk area because we need a certain quantity and quality of milk."

Nestle, till date, has cultivated about 95,000 farmers in and around Moga (Punjab).

"Liberalization is my doctrine. But it has to be applied with a certain degree of caution. If you liberalise, like it is now—a free for all—then my investment will benefit someone else", he points out in anguish.

'Cheer up, Countryside'!

In a bid to branch out to newer avenues and boost sales, liquor companies are now focussing on a segment that has remained untapped—the country liquor segment.

Two liquor majors, McDowell and Shaw Wallace, are trying to make a pitch in the country liquor market, bringing in branded products to cater to the lower-end consumer.

The segment, billed to be the largest in terms of volume and value, is currently pegged at Rs 18,000 crore. There are a lot of local players who mainly rule the roost, as the liquor majors were focussing on the middle and premium segments.

To enter the country liquor segment of various states, Shaw Wallace is investing over Rs 100 crore in its distilleries business and is planning a major restructuring exercise that includes setting up distilleries in every state. They are looking at positioning these brands as a consumer product rather than commoditizing it. The brands are also being named in such a way that it attracts that consumer — *Josh, Janeman and Rangeela.*

The United Breweries Group also has a sizeable market share in this segment, mainly through its flagship companies, McDowell and Herbertsons and is now looking to expand it further.

Maiya-Sabha

Want to watch the Chairman of MTR giving cookery lessons i person? All you have to do is g to "*Namma* MTR", the concept store launched by MTR foods in Bangalore to showcase their nearly hundred food products.

The plush store offers customers an opportunity to "feel our products, experience them, eat them and then buy them," says Mr. Sadananda Maiya, the CMD of the MTR Foods.

"Every evening between 3 ar 4.30 p.m., we have a demo of ou products here and we plan to start conducting cookery classes." And on every Sunday, Mr. Maiya himself will don the apron and give a demo of some of his favourite dishes.

On the ground floor is the superstore offering MTR masala ready-to-eat foods, sweets and frozen foods. *Namma* MTR also has an ice-cream parlour on the first floor. Soon, MTR concept stores may spring up all over Bangalore and in other places in the country.

Now, Pulp Wars!

Godrej has come out with an ad for its Xs brand of mango nectar, which compares it with Parle's brand of fruit drink Frooti.

The ad showing pictures of both Frooti and Xs says " is frootier as i contains 50 p cent more fru pulp". It also adds, "Xs More fruit, More taste".

The ad has obviously raised the hackles of the Rs 670 crore Parle Agro, the makers of the 1 year-old Frooti brand. No wonder Parle Agro is contemplating of legal action. And it i not without reason.

There are different categorie of fruit beverages depending o the percentages of fruit pulp content : fruit drink (with 10 pe cent fruit pulp), fruit juice (wit 100 per cent fruit pulp) and fru nectar (with 20 per cent fruit nectar). Frooti is a fruit drink and Xs is a fruit nectar, the categories are different and the content of fruit pulp in the products varies.

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Editor to Readers

We are happy to carry a brief report on the finding made by two Indian food scientists, Jammala Machaiah and Mrinal Pednekar of BARC that irradiation of beans reduces flatulence (see Bon Appetit, page 5). The paper based on their research work is due to be published by the journal, *Food Chemistry*, and has been put on-line. It caught worldwide attention when *New Scientist* (30 March 2002) carried it with an interesting title, "Gone with the Wind". Reuters, BBC, Chicago Tribune, Tech TV, Yahoo News and other agencies promptly picked it up and reported. We rarely see Indian food scientists drawing this kind of attention and the two women food scientists concerned deserve applause. Beans are known to be very good source of essential nutrients and they also form an important part of Indian diet. Fear of social embarrassment caused by flatulence limits their consumption and it is no doubt a significant discovery that processing them with low-intensity *gamma* rays solves this problem.

The lead article of this issue happens to be "Does ghee sold by any brand smell as sweet? Quality attributes and hedonic price analysis of ghee" by Sathish Deodhar and Vijay Intodia of IIM-A. The article has an important bearing on the post-WTO liberalized market environment wherein there is going to be intense competition between Indian and foreign food companies in the domestic market as well. The authors suggest that understanding of consumers' perceptions and valuation of quality attributes and incorporating the important ones in the product during manufacturing and/or marketing operations enhances one's competitiveness. The study reported on *desi* ghee shows that, besides flavour which is the dominant quality attribute for which consumers are willing to pay more, brand building is extremely important since consumers put faith in the analytical quality—quality they cannot taste—of ghee of a reputed brand.

Speaking about brand building, it involves use of every single vehicle where the customer comes into contact with the brand—packaging, positioning, merchandising, advertising in print, electronic and outdoor media, direct marketing and public relations to create a more conducive environment for the brand. The transformation of a commodity into a brand doesn't come easy. It calls for a consistent and concerted strategy and substantial resources. The brand *gurus* know it all. And the more imaginative ones keep dreaming of creating a brand cult or consumer passion that a brand can command when it morphs into a super-brand, if that ever happens. When Ovaltine, the well known Swiss brand of malt-cocoa beverage has recently been put on the selling block, thousands of appeals and protests came from Ovaltimes (a club of Ovaltine users in UK founded in 1935) asking Novartis, A.G., the owners of Ovaltine, not to sell out to non-Swiss interests. So was the brand passion. Let us hope that Indian food companies don't lose out just because they are not big enough to afford brand building.

GCP Rangarao
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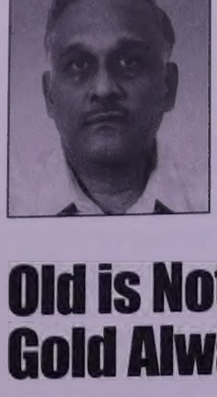


FOOD FOR THOUGHT

V. H. Potty
Contributing Editor

Old is Not Gold Always!

Aging is an irreversible biological phenomenon and man has to live with it in spite of all the modern developments and claims in the area of geriatrics. Millions of rupees are being invested to understand the process of aging and evolve ways and means to arrest this process, if possible to reverse the natural changes accompanying aging. According to WHO, the world population coming under the age brackets of plus 60 years jumped from 290 million in 1970 to 600 million in 2000, the annual growth rate being 3.6%, almost double the rate of normal population growth. This figure is projected to reach a staggering 1.2 billion by the year 2025 which means that the growth rate will touch 4% and continue to increase ceaselessly assuming an alarming proportion of the total population. According to US census reports, more than 27 million people in that country were living by themselves in the year 2000, managing their day to day chores and this figure is projected to reach 31 million by 2010, constituting more than 10% of the American population. With increasing emphasis on birth control programs and reducing mortality rates all over the world, the proportion of plus 60 population in the world including India is bound to go up, posing the biggest challenge of this millenium.

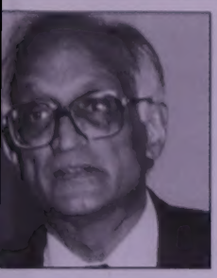
Biological aging is known to be accompanied by several changes at the cellular, molecular, hormonal and physiological levels and no single biological process can be held solely responsible for the aging phenomenon. Overall, the structural and functional changes taking place with progressive aging include changes in appearance, muscular and skeletal systems, senses, cardiovascular respiratory system, digestion, absorption and excretion, reproductive and endocrine systems. Changes in food intake consequent to social, economic, psychological, logistical, biological and pathological changes contribute to nutrient deficiencies, reduced immunological response and physical impairment. Nutritional needs of old people, though remain more or less same as young adults in the case of most of the nutrients, increased intake of proteins, decreased need for fat, Ca, P, Cu and riboflavin and increased levels of folates, cyanocobalamine, pantothenate, biotin, tocopherol and iron in the diet are indicated. Probably, there is an urgent need in India for mobilization of resources and efforts to develop and market genuine geriatric foods with proven efficiency to meet the sensory and nutritional requirements of older population even at the current level of knowledge. While basic research pertaining to extending the life span of human beings to the maximum extent possible is best left to the cash-rich scientific community in the industrialized countries, the responsibility for development of food products in tune with the cultural background obtaining in India rests with the food scientists and technologists of this country alone, who can make use of the basic data generated internationally on geriatric nutrition and health.

The problem is compounded by the emerging trend of "living alone" often found in urbanized regions around the world due to separation by death or divorce and these "singletons", often octogenarians, share a set of common concerns when it comes to healthy living. Flying "solo" by choice or by circumstances can be very exciting and exhausting physically as well as emotionally. One of the first things that happens when people live alone is that they do not adhere to any structured day-to-day life schedule because there is no family to provide for. Often such people are less likely to sit down and actually cook a meal. Invariably, they indulge in their own "bingeing" without giving any thought to consuming sufficient fresh produce and protein. Low intake of vitamin C in old age has been implicated in cancer of breasts, cervix, esophagus, lung, oral cavity, pancreas, rectum and stomach. R duced levels of tocopherol in serum of o people expose them to risks of cancer bladder, melanoma, pancreas, colorectu lungs, lymphoma and others. Probably, i creased generation of oxyradicals in t body takes place due to reduced intake known antioxidants like ascorbic aci tocopherol and *beta*-carotenes. Oxyradica are implicated in many diseases like em physema, cancer, arthritis, artheroscleros cirrhosis, stroke, respiratory distress ar cataract. Thus, for a variety of reasons, significant percentage of elderly populati is at the risk of some degree of malnut tion and specific vitamin deficiencies. Th problem gets compounded by poor dieta intake especially by those in the low soci economic strata, elderly persons livi alone or physically inactive or socially is lated.

Food consumption even amongst we to-do elders is affected by declining visio decreased dexterity, progressive loss of t capacity for taste and smell, loss of tee and consequent use of dentures, decreas saliva flow and consequent problems swallowing, injury to the oral cavity consumption of coarse foods, atrophy the alimentary canal slowing down the gestive process and significant changes the normal flora in the bowel.

While anticipating the inevitable chang during aging, preparing to meet the cont gencies based on our current knowled level, can significantly reduce the trauma aging. Evolving ways and means to reta the undesirable changes associated w aging calls for more research on the conce of "dietary restriction" well establish with animals to slow down aging and p long life.

'Old' is definitely not 'gold' as far *Homo sapiens* are concerned but it should possible to provide at least a "silver linin for our aging population by enabling th to age gracefully, painlessly and peaceful through the collective efforts of sociologis food scientists and technologists and me cal fraternity before the end of this deca in the new millenium.



BETWEEN THE BITES

A. S. Aiyar
Contributing Editor

Food Fortification- Facilitation Vs. Disablement

It is now well-recognised that inadequacy of several micronurients (vitamins and minerals) in the diet is widespread in many parts of the world, resulting in deficiency diseases. In India, vitamin A, iron and iodine have been identified as the major nutrients of public health concern, and the fortification of foods with these micronutrients would be a desirable national nutrition objective.

The document, 'Strategy for elimination of micronutrient malnutrition in India', comprising the proceedings of a workshop held in November 1995 by the Government of India in collaboration with the micro-nutrient initiative and the UNICEF states : "Food fortification is an approach with immense potential to reach micronutrients to large populations in India at an affordable cost. While several foods are already being fortified today, there are many more promising opportunities using salt, sugar, oils and ready-to-eat foods that have larger coverage and impact". This belief has been reaffirmed in several subsequent national and regional conferences that have been organised since then, but the flavour in the policy statements has not been matched by actual developments. This write up focuses on some of the regulatory uncertainties that act as a disincentive to the food processing industry, possessing the necessary technical and marketing expertise, in playing its legitimate role in the commercial manufacture and distribution of fortified foods.

If the addition of nutrients to specific foods can be an effective way of improving the overall nutritional quality of the food supply and is, therefore, a desirable societal objective, the food laws must facilitate the practical adoption of this concept. The need for regulatory prudence and control arises from the fact that indiscriminate addition of nutrients could have adverse consequences to public health.

Among the provisions in the Prevention of Food Adulteration Act and Rules, which are relevant to food fortification are the following:

1. According to Rule 5, foods for which 'standards of quality' are specified in Appendix B of the PFA Rules, should conform to the specifications prescribed therein. If the standard for any food product does not explicitly specify the inclusion of vitamins and minerals, either as a class of nutrients or by name, then there is no legal sanction for such an addition. The provision of separate standards of quality for 'fortified' food items, to differentiate them from their unfortified counterparts, reinforces this contention. (Table 1)
2. There are only a few specified foods covered in Appendix B, whose standards of quality include added nutrients. In the case of seven of these foods, it is mandatory to add specified nutrient(s) at prescribed levels. (Table 2)

One or more micronutrients may be voluntarily added to a few other foods, since their standards of quality specifically provides for the same. (Table 3)

This strait-jacketed approach to the addition of nutrients in foods, which are covered under Appendix B is a serious dampener to the spirit of innovation of the manufacturer and an infringement of the freedom of choice of the consumer.

There are also regulatory provisions relating to the labelling of foods containing added nutrients:

1. The relevant rule, currently in existence, viz., Rule 32-A makes it mandatory that 'the food claimed to be enriched with nutrients such as minerals, proteins or vitamins shall give the quantities of such nutrients on the label'. The proposed amendments to this rule governing 'nutrition labelling', which are currently being finalised, have more exhaustive provisions. One of

Table 1. Fortified Foods with Separate Standards

Food	Standard of Quality	Fortified Food	Standard of Quality
Edible Common Salt	A-15	Iodised Salt	A-15.01
		Iron Fortified Common Salt	A-15.02
Atta	A-18.01	Fortified *Atta*	A-18.01.01
		Paushtik *Atta*	A-18.01.02
Maida	A-18.02	Fortified *Maida*	A-18.02.01
		Paushtik *Maida*	A-18.02.02
Mineral Water	A-32.1	Fortified Mineral Water	A-32.2

Table 2. Foods in Which Nutrient(s) Addition is Mandatory

Food	Standard of Quality	Nutrient(s) to be Added
Table Margarine	A-12	Vitamin A
Vanaspati	A-19	Vitamin A
Vegetable Fat Spread	A-31	Vitamin A
Infant Milk Food	A-11.02.18	Vitamins Minerals
Infant Formula	A-11.02. 18.01	Vitamins Minerals
Milk Cereal Based Weaning Food	A-11.02. 18.02	Vitamins Minerals
Processed Cereal Based Weaning Food	A-11.02. 18.03	Vitamins Minerals

Table 3. Foods in Which Nutrient(s) Addition is Voluntary

Food	Standard of Quality	Nutrient(s) Addition Permitted
Bread	A-18.14	Lysine
Fruit Juice	A-16.01	Vitamin C
Fruit Beverages	A-16.05	Vitamin C
Tomato Ketchup	A-16.06	Vitamin C
Jam	A-16.07	Vitamin C
Marmalade	A-16.09	Vitamin C
Fruit Jelly	A-16.15	Vitamin C
Biscuit	A-18.07	Nutrients
Malted Milk Food	A-18.12	Vitamins Minerals
Macaroni	A-18.11	Vitamins Minerals
Confectionery (other than chocolate)	A-25	Vitamins Minerals

the sub-rules in the proposed amendment makes a reference to nutrient content 'per serving' of the food. In the absence of any standardization of the 'serving size' for any food, this can only lead to confusion and uncertainty. It is an example of an attempt to introduce a concept into the regulations, without an appreciation of the enormity of the spade work that is required before it can be enforced.

2. According to Rule 39, the label for a food should not use 'any words that imply or suggest that the food is recommended, prescribed or approved by medical practitioners, or approved for medical purpose'. In the proposed amendment to rules relating to 'nutrition labelling', Rule 32 B (3) (iii) prohibits claims 'as to the suitability to a food for use in the prevention, alleviation, treatment or cure of a disease, disorder or particular physiological condition'. While these rules may be well intentional for a purpose, they may become unintended regulatory roadblocks to food fortification. Any public health measure requires creation of widespread awareness through various media and a lay person can more easily understand the link between a nutrient deficiency and an ill-health manifestation, than the underlying physiological or biochemical functions. If you cannot proclaim the benefits of prevention of a disease by addition of the relevant nutrient to the food, how else do you promote the public acceptance and consumption of such foods ?

Perhaps the greatest amount of confusion and uncertainty is created by Rule 43. While the main clause is simple and direct and reads, 'every....label for an article of food which contains an addition shall describe the food as containing an addition and shall also specify the nature and quantity of such addition', the various sub-clauses are the source of considerable ambiguity and contradiction of other rules. One of these states, 'provided for the purpose of this rule, the following shall not be deemed as an addition' – 'vitamins in foods', contradicting all the provisions, existing and proposed, of nutrition labelling. Another sub-clause reads, 'nothing contained in this rule shall apply in the case of sweets, confectionery, biscuits, bakery products, processed fruits, aerated waters, vegetables and flavouring substances'. This flies in the face of Rule 5, since almost all these products have a standard of quality prescribed in Appendix B and, therefore, cannot have any addition that is not permitted in their standard of quality. According to another sub-rule, 'nothing contained in this rule shall be deemed to authorise any person to sell any article of food required under the act or these rules to be sold in pure condition, other than in its pure condition, while in a way it states the obvious, i.e., that no food will be adulterated, it also contradicts some of the other sub-clauses under Rule 43.

The PFA Act and Rules also contain several irrationalities relating to food fortification which in all probability were not intended, but there can be no justification for their continued existence in the statute books. A few such examples are:

a) As prescribed in the standards of quality, sugar boiled confectionery, lozenges and chewing gum are permitted to have added vitamins and minerals, but not chocolate, although all of them belong to the....

b) *Atta* can be fortified with either vitamins and minerals or protein, but there is no provision for adding both categories of nutrients. Likewise, common salt can be enriched with either iodine or iron, not both.

c) Only one of six specified chemical forms of iron can be used for fortifying infant and weaning foods, but there is no such stipulation on the form of iron for fortifying common salt.

d) The phraseology of the specific provision [Rule 40 (3)] enabling the addition of vitamin C in fruit products reads, 'any fruit and vegetable product alleged to be fortified with vitamin C... of the product' and is an anachronism that makes a desirable act appear unethical.

e) Macaroni can be enriched with vitamins and minerals, but not semolina!

Although many staple foods, as well as widely consumed processed foods could be the ideal vehicles for fortificants, the addition of nutrients to most of these foods would be violative of the legal provisions. Among the foods, whose standards of quality does not permit the addition of nutrients are:

a) Staple foods : Spices, sugar, vegetable oils, cereal grains, semolina, bread, pulses, besan, milk, tea and coffee.

b) Prepared foods : Carbonated water, flavoured milk, *paneer*, ice cream, cheese, yoghurt, fruit beverages, jam and chocolate.

Notwithstanding the legal position as it exists at the present time, research investigations, as well as pilot studies have been carried out with some of these foods, as potential purveyors of added nutrients. The exploitation of these findings would, however require enabling amendments to the regulations.

Prompted largely by developments in other parts of the world and the entry of some nutrient – enriched food products from abroad following the trade liberalisation, a handful of fortified foods have also been commercially manufactured in the country in very recent times. (Table 4)

Fortified products do not have explicit legal sanction and are, therefore, actionable for violation of the standards for these products. Although some manufacturers have considered it fit to provide these nutritionally value-added products to the consumer, the large majority consider it prudent to await clear provisions on food fortification,

Table 4. Fortified Food Product in the Market Whose Standard of Quality Do Not Provide for Nutrient Addition

Food	Added Nutrient(s)
Fruit Squash	Vitamins A & B3
Jam	Vitamins A & B3
	Calcium
Flavoured Milk	Vitamin A
Corn Flakes	Vitamins, Iron
Salt	Potassium, Calciu
Bread	Vitamins
Veg. Fat Spread	Vitamin D & E
Milk	Vitamin A

before venturing to manufacture them fact, it may be pointed out that there l been instances of food products impo into the country which have been deta as they are violative of the provisior PFA, because they are fortified with n ents ! These include fruit juice with r ral *beta*-carotene, chocolate with vitam and margarine with added fat soluble mins.

Many of the infirmities in our food l particularly relating to food fortifica have been commented upon in many over the years. The official publicatio the proceedings of the Jaipur Worksho 1995 makes the following observati "Legislation currently in force is inap priate... This forces even the most soc responsible of manufacturers to shy a from undertaking food fortification. "C often existing food standards and law cluded under the PFA Act obstruct pr development of food fortification. Ra alisation of the PFA Act and Rules to come these obstacles and easy compli is an urgent priority".

Such sentiments have been reiter periodically but these critical referenc the serious regulatory hurdles to food tification have not prompted any effo identify specific infirmities in the pre regulations, let alone address them. W out the enabling legislative provisior translate policy decisions into program food fortification will continue to rer largely as pious pronouncements.

Regulatory aspects of food fortifica are an important, but to a great extent addressed issue. Over-emphasis on sa can only deny the potential health ben to the public and only a balanced appr that is in consonance with the nati policy on food fortification, can ensur convergence of all interests—those o government, the industry and the pub

'Never put off doing something u for fear of evil that may never arri James D. Watson.

Does Ghee Sold by Any Brand Smell as Sweet ? Quality Attributes and Hedonic Price Analysis of Ghee

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Abstract

In the post-WTO scenario, processed food industry is witnessing intra-industry trade, i.e., trade in similar products. It also means that there will be intense competition between foreign and Indian companies in the domestic market. This competition will compel companies to focus their attention on product differentiation and branding. This is possible if companies prepare themselves to be quality competitive. In order to be quality competitive, firms have to understand consumers' perception and valuation of various quality attributes. Hedonic price analysis, a methodology used for this purpose, is extensively used for processed food products in developed countries. However, it has not been applied to Indian food markets.

We conduct a hedonic price analysis of a typical Indian processed food product – ghee. Results indicate that consumers are willing to pay a premium for branded over non-branded ghee, and, for corporate brands over cooperative brands. Flavour is an important quality attribute valued by consumers. While texture is not that important, an agreement needs to be developed on whether or not there is an ideal colour attribute for ghee. The results imply that branding generates reputation, and, cooperatives may want to enhance their brand equity. Firms may do well in improving flavour to enhance ghee quality. Another implication is that large firms and other organizations need to generate data on measurements of food quality attributes so that hedonic price analysis can be effectively used for strategic food quality management.

(Continued on page 12)

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equimarginal utility for the numeraire good X and the characteristic z_j. dPg/dz_j is the marginal implicit price for characteristic z_j and corresponds to the regression coefficients when estimating equation (1). Further, the utility function U can be rewritten as:

(4) $U = U (M - Pg_i , z_{i1}, \ldots, z_{ij}, \ldots, z_{in})$.

Inverting equation (4) and solving for Pg_i with z_j as a variable and U^* and $\mathbf{z}^*_{-j}$ being held constant at their optimal values associated with problem in (2), we can write a bid curve Bj as follows:

(5) $B_j = B_j (z_j, \mathbf{z}_{-j}^*, U^*)$

Holding other things at the optimal level, equation (5) describes the maximum amount an individual would be willing to pay for a unit of ghee as a function of z_j. A well-behaved bid curve is ought to exhibit a diminishing willingness to pay with respect to z_j. Based on their individual preferences and/or incomes consumers can have different bid curves $B^1_j(z_j)$ and $B^2_j(z_j)$ as shown in Figure 1.

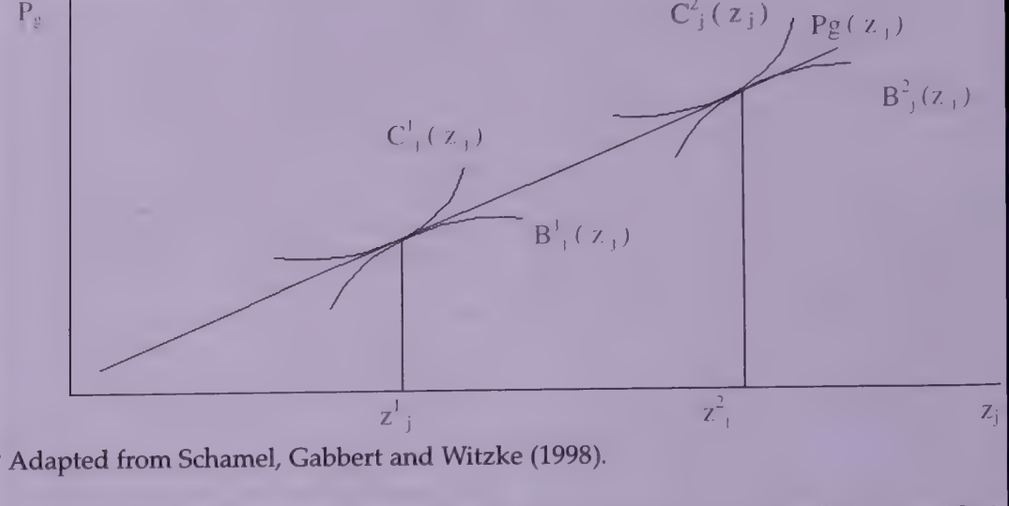
On the supply side as well, firm's cost of production depends on the characteristics of the product. Offer curve for the characteristic z_j derived from the firm's cost function can be represented by:

(6) $C_j = C_j (z_j , \mathbf{z}_{-j}^*, \pi^*)$

Equation (6) explains the minimum price a firm would accept to sell a unit of ghee as function of z_j, holding other attributes and profit at the optimal level. Offer curves $C^1_j(z_j)$ and $C^2_j(z_j)$ for two individual ghee producers are also shown in Figure 1. Now, the equilibrium condition is that bid and offer curves for all quality attributes and for each market participant must be tangent to the Hedonic Price Function $Pg(z_j)$, which is an equilibrium locus for all individual bid and offer curves.

Ideally, to study the valuation of quality characteristics by the buyers of ghee one would like to model both the demand and supply sides. However, for estimation purpose we have considered only the demand side of the ghee market. Freeman (1992) shows that assuming the markets to be competitive and in equilibrium, implicit price of an i^{th} brand of a product can be specified without modelling the supply side. Also, with no significant changes expected in the branded ghee supply in the short-run, and, only a cross-sectional data at a point in time being available for the analysis, we assume that supply is exogenously determined. Moreover, only the data on sensory and other attributes relevant for the demand side estimation were available.

Fig.1. Bid and Offer Curves and Hedonic Price Line*



* Adapted from Schamel, Gabbert and Witzke (1998).

Data and Regression Analysis

Our objective is to estimate a hedonic price line as discussed in equation (1) and as shown in Figure 1. It involves regressing ghee prices on explanatory variables that are measures of quality attributes for ghee. There are various sensory and analytical quality attributes of ghee. The sensory attributes are essentially the organoleptic attributes which a consumer is able to detect. One such sensory quality attribute of ghee is its flavour. Flavour is a combination of smell and taste. Ghee is flavourful if it does not have burnt, rancid, curdy, oxidized, or smoky smell. Moreover, traditionally, homemade or *desi* ghee is supposed to have 'grainy' texture or feel. Lack of grainy texture indicates presence of excess oxygen which may give a bad smell due to oxidatio Another sensory attribute of ghee would its colour. Among the analytical attribut pesticide residues, heavy metal residues a adulteration are of considerable importan

Data for this empirical study has be taken from a test report published by CE (2001). The report covers almost more th 80 percent of the ghee brands available India. Although it reports scores for both t sensory and the analytical quality attribut we use only the sensory scores as consu ers' perception is based mainly organoleptic quality attributes. Their perce tion is not based on analytical attributes si ply because these cannot detect these tributes while consuming. While CE gives subjective weights to each quality tribute, we give equal weight to all senso attributes. Further, we hypothesize that co sumers' perception and hence the price w also be determined by two other facto namely, whether the ghee is branded or n and, whether the ghee is sold by corpor entities or co-operatives. We hypothesi that these factors may account for the fa consumers have in the analytical quality ghee which they are unable to measu merely by tasting. There were 15 brand ghee samples and 2 were sold lose. Mor ver, 10 samples were from corporate sec (Nestle, Britannia, and others), 5 from coo erative sector (Amul and others), and 2 fr the unorganised sector. The description variables is provided in Table 1.

Table 1. Description of Variables*

Variable	Description	Mean	St. Dev.
P_g	Max. retail price of ghee/500 gm	82.42	12.02
Z_1	A score for the attribute: Flavour	9.23	0.64
Z_2	A Score for the attribute: Texture	7.77	0.11
Z_3	A Score for the attribute: Colour	8.98	1.32
Z_4	= 1 if Corporate, = 0 otherwise	0.71	0.47
Z_5	= 1 if branded, = 0 if sold lose	0.88	0.33

* Adapted from CERC (2001) for variables P_g and Z_1 to Z_3.

Given the data above, we estimate the Hedonic Price function in (1) in the following form:

(6) $P_{gi} = a_0 + a_1 Z_{i1} + a_2 Z_{i2} + a_3 Z_{i3} + a_4 Z_{i4} + a_5 Z_{i5} + e_i$

The estimation of regression equation and its diagnostic tests are reported in Table 2 and Table 3 respectively.

Table 2. Regression Estimate

Variable	Coefficient	Std. Error
Constant	183.76	140.04
Z_1	9.56[a]	4.55
Z_2	-21.7[b]	18.31
Z_3	-6.21[c]	2.07
Z_4	20.27[c]	4.63
Z_5	23.90[c]	5.73

[a]Significant at 0.03 one tail test and 0.06 two tailed test. [b]Not significant even at 0.10 two tailed test. [c]Significant at 0.01 two tailed test.

The multiple coefficient of determination, R^2 is 0.76 and the adjusted R^2 is 0.66. The overall significance of the regression equation is quite satisfactory. In fact, the F statistics of 7.1 is significant even at a very stringent significance level of 0.003. Cross sectional data is prone to heteroscedasticity problem. Hence, we test the regression equation for heteroscedasticity using B-P-G and Glejser tests. The estimated χ^2 values are not significant both at 0.01 and 0.05 significance levels. Hence we cannot reject the null hypothesis of homoscedasticity. We have also tested for the multicollinearity between 3 explanatory variables. As per the Klien's rule of thumb all the auxiliary R^2 values were found to be lower than the overall R^2 which confirms the absence of multicollinearity.

The regression equation indicates that consumers are willing to pay a premium of about Rs 24 for a branded ghee over an unbranded ghee sold lose in the market. Moreover, corporate brands too command a premium. Consumers are willing to pay a premium of about Rs 20 for a corporate brand of ghee over a co-operative brand. Both the coefficients in the regression are significant at 0.01. This indicates that brand and the nature of firm contribute to the reputation premium. This result is similar to that of Shapiro (1983) and Oczkowski (2000) as mentioned earlier in the literature review. This premium may be reflective of the faith consumers have in the analytical quality attributes of ghee which they are unable to taste for themselves. Flavour has a considerable and significant impact on price. For a unit improvement in the flavour score consumers are willing to spend additional Rs 9.60. Texture on the other hand does not seem to be influencing the willingness to pay as its coefficient is not statistically significant. As regards the colour attribute, it appears that consumers are willing to pay Rs 6 less for every improvement in the colour quality.

Although Rs 6 is a small amount, this negative relation needs some discussion. There seems to be some ambiguity regarding the colour attribute of ghee. The CERC defines 'creamy' as the ideal colour of ghee. However, we wonder how consumers interpret the creamy colour. Is it creamy white or creamy yellow or something in between? A leading corporate brand, Milkman, mentions their ideal colour of ghee as creamy white. Another Brand GITS included in the sample boasts of 'Bright Yellow' Colour. GITS informs the consumers that this colour is due to the presence of beta carotene, the naturally occurring source of vitamin A. Moreover, we are given to understand that ghee made from cow milk is yellow in colour as against the white colour for the ghee made from buffalo milk. To complicate matters further, the milk used in ghee production could be a mixture of cow and buffalo milk. Hence, 'not-creamy' need not have received a lower score on the colour attribute.

Summary and Conclusion

The recent post-WTO experience shows that processed food industry is showing features of intra-industry trade. Presence of intra-industry trade implies that there will be intense competition between Indian and foreign processed food companies in the domestic market as well. In this context, product differentiation and emphasis on quality competitiveness will assume importance. Enhancing quality competitiveness requires understanding of consumers' perceptions and valuation of variety of quality attributes and incorporating the important ones in the product during manufacturing and/or marketing operations.

We apply the hedonic price analysis to the Indian *desi* ghee to understand consumers' perception and valuation of various quality

Table 3. Evaluation of the Regression Equation

	Diagnostics	Test	Value
1.	Coefficient of: Determination	R^2	0.76
		Adjusted R^2	0.66[e]
2.	Overall significance:	F statistics	7.1[e]
3.	Homoscedasticity Tests:	B-P-G χ^2	3.8[d]
		Glejser χ^2	4.0
4.	Multicollinearity	Klien's Rule	$R^2Z\,1 = 0.535$[f]
			$R^2Z\,2 = 0.018$[f]
			$R^2Z\,3 = 0.540$[f]

[d] not significant at 0.01 and 0.05. [e]Significant at 0.003. [f]Auxillary R^2s less than overall R^2

attributes of ghee. Results show that consumers put a premium not only on branded ghee but on the nature of firm as well, i.e., corporate brands earn a premium over brands sold by cooperatives. Moreover, flavour is the dominant quality attribute for which consumers are willing to pay more. Texture does not appear to be that important an attribute. Moreover, colour attribute shows a negative relation to price, although we wonder whether there could be a unique ideal colour attribute for ghee. Implications of these observations are the following: Building brand reputation is extremely important. Moreover, cooperatives need to enhance their reputation through marketing and advertising to effectively compete against corporate entities. Amul might be the only exception to suggestion. It could very well be that the premiums may be a reflection of consumers' faith in the analytical quality of ghee which they are unable to taste. In terms of sensory attributes, ghee manufacturers would do well to focus more on flavour attribute than any other attribute. There seems to be a need to develop an agreement on what would be the ideal colour attribute for ghee.

There are some general implications as well. In the developed countries, numerous such studies have been done. Food processing firms benefit from such studies. Firms are able to identify the quality attributes of a product that consumers value most and work on improving these attributes of their food products. In the post-WTO liberalized environment, managers and professionals associated with the Indian food industry must incorporate this strategic food quality management tool if they have to effectively compete with foreign brands. Moreover, as a prerequisite, it is imperative that efforts be made to identify quality attributes of variety of processed food products, identify tests to measure these attributes quantitatively, and perform consumer preference surveys on various brands. This could be done by large companies themselves or as is done by food laboratories and organizations such as CERC.

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NEWS & ANALYSIS

GENERAL

PEDA to ormulate roduct pecific trategy

Targets at double export urnover by the end of the Tenth Plan.

Identifies eight products including Basmati, mango, grapes, litchi and meat.

Agricultural and Processed Food Products Export Development Authority (APEDA) is formulating a product specific ategy to boost agricultural d processed foods exports ring the Tenth Plan. It is ning at doubling the export nover from the present Rs 000 crore to Rs 20,000 crore the end of the Tenth Plan. PEDA has identified eight ferent products including smati, mango, grapes, litchi d meat.

Agri-export zones (AEZs) uld back this product ecific strategy. Recently, the ion Government has signed arly 10 MoUs with various tes to set up AEZs, entailing investment of Rs 200 crore. ese zones have the potential contribute nearly Rs 1,700 re to the exports turnover in e next five years.

Despite the current wdown, exports of agricul- al and processed food oducts are expected to show narginal 1-2 per cent growth ring the current financial ar. While egg products and ocessed vegetables have tnessed some improvement ring the year, exports of smati rice and meat products ffered to some extent.

Walk-in-type Cold Storage at Lucknow Airport

- **Tripartite agreement between APEDA, AAI and the local Mandi Parishad necessary for realizing the project.**
- **Utilization level less than 20 per cent in the country with Bangalore ranking the lowest.**
- **75000 sq mts of space identified for construction of an integrated air cargo complex in Rajiv Gandhi International Airport at Hyderabad.**

Agricultural and Processed Food Products Export Development Authority (APEDA) has plans to set up a walk-in-type cold storage in Amausi airport at Lucknow. A tripartite agreement between APEDA, Airport Authority of India (AAI) and the local Mandi Parishad is necessary for launching the project. While APEDA and Mandi Parishad have already reached consensus, AAI is yet to express its concurrence. AAI's concurrence is significant for it has to provide the non-air conditioned covered space and plug points for installation of walk-in-type cold room and also the space for positioning Mandi Parishad staff.

The licence fee, at the rate as applicable to government departments from time to time, for the space, including staff room, will be paid by the Mandi Parishad.

Further, APEDA has initiated interaction with airlines, exporters, AAI and others to ensure that the cold facilities are utilized to the maximum possible extent.

At present, the utilization level is less than 20 per cent. The country's total perishable exports, requiring cold storage facilities, are of the order of 75,000 tonnes. Alarmingly, the total cold storage facilities available at various airports are about 1,50,000 tonnes, of which approximately 20,000 tonnes are utilized.

With 3.1 per cent, Bangalore airport ranks lowest in utilization levels and Thiruvananthapuram the highest with 47 per cent. 8.3 per cent at New Delhi, 20.7 per cent at Chennai and 7.4 per cent at Hyderabad are the levels of capacity utilization at these airports.

One of the reasons for the low throughput of perishables is the absence of direct flights to foreign countries. For example, Bangalore airport does not have a direct cargo service to Europe, particularly Amsterdam, where the flowers are mainly exported.

Meanwhile, an area of 75000 sq mts has been identified for construction of an integrated air cargo complex in Rajiv Gandhi International Airport at Hyderabad. AAI is required to allot the space to the concerned State Government agency for the construction.

APEDA Plans to Unveil 'Made in India' Logo

- **To provide official identity or seal of approval for quality.**
- **To be used for Basmati rice and extended to other products when basic quality parameters are defined.**
- **Exporters can display logo on their consignments if they meet product specific quality, processing hygiene standards.**

The Agricultural and Processed Food Products Export Development Authority (APEDA) is planning to develop an exclusive *'Made in India'* logo, which can be utilised by exporters of agro and food products. Initially, the logo would be used for basmati rice as the quality parameters are already well defined. Mangoes and gherkins, may follow next, as similar norms exist. As and when the basic quality parameters for other products are determined, the logo would be extended to them.

Any exporter of agro and processed foods can display the logo on their consignments provided they meet the product specific quality and the processing hygiene standards stipulated by APEDA. This will give some sort of official identity or seal of approval for quality, thereby imparting confidence among the buyers, which will help exporters realize a better price for their produce.

Today, the basic problem arises from the sheer number of companies and individuals engaged in exports of agro and food products. There are so many players that it is not possible to physically monitor each exporter or check each consignment for quality. Hence, APEDA is trying to induce exporters to come forward and gainfully use this logo, in which case they have no alternative but to follow the prescribed quality standards.

POLICY

Amul, Nestle Oppose Scrapping of Milk Shed Concept

- **Amendment to MMPO proposed for removing restrictions on new milk processing capacity, particularly restrictions concerning licensing capacities and milk shed area.**
- **15% depreciation to new plants, machinery acquired from April 1 onwards for new industrial units as well as expanding installed capacity by at least 25%.**

In his budgetary speech, Finance Minister Yashwant Sinha proposed to limit the purview of the Milk and Milk Products Control Order (MMPO), 1992, to encourage private sector participation. In order to remove restrictions on new milk processing capacity, particularly the restrictions concerning licensing capacities and milk shed area, which dictate the area within which the private sector can procure milk, an amendment in MMPO has been proposed. However, details regarding the milk shed area are not yet disclosed.

Further, additional depreciation at the rate of 15 per cent to new plants and machinery acquired on or after April 1 for new industrial units and for expanding installed capacity by at least 25 per cent has been announced. Even while there is no reference to milk sheds *per se* in Sinha's speech, his statements only imply the scrapping of the 'milk shed' concept in the MMPO.

Since July 1991, the dairy industry stood technically delicensed. But the existing MMPO requires any dairy plant that processes more than 10,000 litres of milk per day to obtain governmental registration. For this, the entrepreneur setting up the plant has to first declare his proposed milk shed area. The registration certificate will be issued only if there is surplus milk available in the said milk shed and there is no other plant operating there. The milk shed is defined as an area geographically demarcated by registering authority for the collection of milk or milk product by the holder of a registration certificate.

Under section 11 of the MMPO, every holder of registration certificate shall collect or procure milk only from the milk shed assigned under the registration certificate. The main purpose of allocating designated milk sheds was to prevent situations where dairy processing capacities ended up being far in excess of potential raw milk supplies. If there already exists a dairy, which can make use of the available surplus milk in a particular area, there is no point giving registration for yet another plant for the same surplus milk.

According to Sinha, there would henceforth be no restrictions on new milk processing capacity. This virtually means that the milk shed concept will no longer be a consideration in the granting of registration certificate.

While entrenched players like Amul and Nestle India have opposed the abolition of the milk shed concept, those in favour of this argue that milk sheds provide exclusive monopoly to individual dairies for procuring milk within the designated area and, in the process, the farmer is denied the possibility of obtaining a better price for milk supplied by him.

However, Amul and Nestle India stressed that assigning specific milk sheds to individual dairies provide an incentive to the later to undertake farm level investments in boosting milk yields. As milk is not produced from dairy plants, if the milk yields have to go up, heavy investments in disease control, genetic improvement of stock, feeding and extension programmes is necessary. But no dairy would make these investments, if the gains from these accrue to someone else who poaches into the milk shed area, which it has nurtured over many years.

PFA Norms for Honey, Oil, Salt Amended

- **New specifications in line with Codex for honey.**
- **Test of argemone oil should be negative in all edible vegetable oils, fats.**
- **Anti-caking agents' quantities not exceeding 2 per cent permitted for edible common salt, iodised salt and iron fortified salt.**

Government has amended the specifications of honey, vegetable oils, fats, salt in the Prevention of Food Adulteration (PFA) Rules, 1955. Detailed specifications in line with international specifications, i.e., Codex, have been laid down for honey. Additional requirements of ash, acidity (expressed as formic acid) and hydroxy methyl furfural have been incorporated.

According to the new amendment, the test of argemone oil shall be negative in all edible vegetable oils and fats, and the public analyst laboratories/central food laboratories shall test the samples for the presence of argemone oil compulsorily.

In case of edible common salt, iodised salt and iron fortified salt, anti-caking agents' quantities not exceeding 2 per cent either singly or in combination have been permitted. The anti-caking agents include carbonates of calcium and magnesium; phosphate of calcium and magnesium; silicates of calcium, magnesium; aluminium or sodium or silicon dioxide; myristates, palmitates or steaates of aluminium, ammonium, calcium, potassium or sodium.

BIFR Confirms Closure of Hindustan Veg. Oil

- **Bench suggests GOI to consider giving one more chance to workers to opt for voluntary separation scheme.**
- **Nearly 122 workmen of the Breakfast Food (BFF) unit have not accepted VSS.**
- **Except Mumbai and Bangalore units, all other divisions of the company were expected to suffer continuous losses.**

The Board for Industrial and Financial Reconstruction (BIFR) has confirmed its *prima facie* opinion on winding up the sick industrial company, Hindustan Vegetable Oil Corporation Ltd.

However, the Bench has suggested the Government of India to consider giving one more opportunity to the workers to opt for voluntary separation scheme (VSS) in view of avoiding undue hardships to the workmen.

Further, the promoters, Government of India, have recommended that the unit be wound up. Also, IDBI has stated that most of the units were technically unviable.

Nearly 122 workmen of the Breakfast Food (BFF) unit have not accepted VSS, whereas the rest of them have accepted the scheme.

The bench has noted that the company is not likely to make its net worth exceed its accumulated losses within a reasonable time while meeting all its financial obligations.

In December 1999, HVOCL was declared a sick company. IDBI forwarded a copy of the techno-economic viability

ly report and the valuation ort of the company to the ch, in April 2001.

At a joint meeting, held on e 12, 2001, the promoters erated that they were not position to provide funds the revival of the company that the Union Cabinet decided to close down OCL. Except Mumbai and galore units, all other isions of the company were ected to suffer continuous ses and therefore the npany as a whole would be urring continuous losses, d IDBI. The Board, vide its er dated September 2001, d issued a showcause notice o why the company should be wound up.

MFPI Moots More Aid for Food Parks in 10th Plan

- **To increase financial assistance from existing Rs 4 crore per park.**
- **Power, water, packaging and incubator facilities as infrastructural facilities at parks in the proposal.**
- **Stress on promoters - State Government Industrial Development Corporations or private parties - for investing at par with Centre.**

The Ministry of Food Processing Industries (MFPI) has plans to propose increase in financial aid for food parks in the Tenth Five Year Plan. It observed that the existing assistance of Rs 4 crore per park is inadequate, particularly, if they wanted private participation.

Commenting on the scepticism expressed by few sections of the industry, the Ministry said that a gestation period of 3-4 years is required - quoting the example of the famed food park in France, which took nearly 10 years to develop.

Power, water, packaging and incubator facilities have also been added by the Ministry to the list of common infrastructural facilities for the 26 food parks that are being set up. Efforts are also afoot to synergise the food parks along with agri-export zones (AEZs).

However, MFPI is not in favour of dedicated food parks, as the operations would become seasonal. The Ministry has also stressed that the promoters, be it the State Government Industrial Development Corporations or private parties, need to invest at least an amount equal to the Centre's assistance, if not more. Further, it said that based on this and its utilization, the next instalments would be released.

Food parks had been cleared in Madhya Pradesh, Maharashtra and Karnataka. Karnataka has received clearance for two parks, even as it recieved in-principle clearance for another four parks.

CORPORATE-INDIAN

allya's Stake in UB May Drop

UB Group Chairman Mallya's stake in UB Ltd. may fall to 38% from existing 52%.

S&N will infuse Rs 250 crore through preference shares and loan stock into UBB, convertible into 26 per cent equity.

S&N will invest Rs 175 crore into a joint venture SPV.

The equity stake of Vijay llya, the UB Group airman, in UB Ltd. y fall to 38 per cent m the existing 52 per nt if Scottish & wcastle (S&N) nverts its proposed vestment of Rs 250 re into equity. S&N ikely to cap it's holding in Beer (UBB) at 26 per cent.

S&N can convert its investents into equity anytime thin five years. However, it expected to do so at the rliest. Still, the UB Group ould continue to hold more an 51 per cent stake.

As per the agreement tween S&N and UB Group, e former would infuse Rs 250 re through preference shares d loan stock into UBB, nvertible into 26 per cent uity. Analysts have slammed the pact for its complicated structuring and they sense that the contours of the deal could change dramatically in future.

Also, S&N will invest Rs 175 crore as fresh capital into a joint venture SPV (special purpose vehicle), which is expected to play the role of "growth engine " for UBB and cement its dominance in the domestic beer market.

If UBB's valuation soars in the wake of de-regulation, S&N may infuse fresh capital into the company to get 26 per cent.

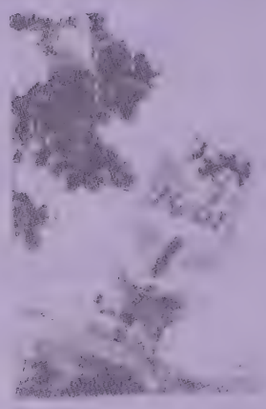
S&N will have one director on the board of UBB. What is even more important is that there is a long list of affirmative rights, which will give S&N a meaningful role in UBB's affairs.

The newly floated joint venture SPV and the UB Group, where both the parties hold 40 per cent of stake each, will be merged with UBB once S&N picks up 26 per cent equity stake in the later.

Their plan is to have only one brewing entity in future. S&N's strength in UB's board could go up after the merger, but details in this regard were not finalised.

Dabur's "Real" Export Effort

- **Dabur to explore Maldivian, US and Russian markets for exporting fruit juices and honey.**
- **Dabur's agricultural centre for honey in Nepal engaged in the production of organic honey, naturally produced honey and honey in crystallised form.**
- **Real brand accounts for 80% of Dabur Foods' turnover, Hommade cooking pastes and Lemoneez lime concentrate account for the rest.**



Dabur India Ltd. has started exploring markets in Maldives, US and some Russian markets for the export of its brand of fruit juices and honey. Fruit juices will be exported under the "Real" brand name, which has its manufacturing facility in Nepal.

The company has set up an agricultural centre for honey in Nepal that is engaged in the production of organic honey, naturally produced honey and honey in crystallised form. These products are solely for the export market. Nepal, Baddi in Himachal Pradesh and Narendrapur in West Bengal are the three manufacturing bases of Dabur for honey.

Also, the company is considering the possibility of exporting Hommade cooking pastes. The pastes in six variants are produced at its manufacturing base in Sahibabad, UP.

On the domestic front, Real is the Dabur Foods' flagship brand, accounting for around 80 per cent of the company's turnover. Last year, the Real brand was extended to Real Activ, a non-sweetened variant of fruit juices positioned on health platform. Dabur Foods' other existing brands - Hommade cooking pastes, Lemoneez lime concentrate - account for remaining 20 per cent of its turnover.

Meanwhile, the company has decided not to introduce papads in the domestic market, which was test marketed in key Southern markets.

Cheez-it Crackers, Keebler.... Gets Green Signal from FIPB

- **FIPB permits Kellogg's four new products, continuing payment of royalty to its parent without duration limit.**
- ***Cheez-it Crackers, Keebler, Cookies* and *Special K Cereal* are to be launched.**
- **Royalty paid at the rate of 8% on exports and 5% on domestic sales for providing technical know-how.**

Foreign Investment Promotion Board (FIPB) has given clearance for US-based Kellogg Company Inc's Indian subsidiary to launch four new products and to continue paying royalty to its parent without any limit on the duration of payment.

Cheez-it Crackers, Keebler, Cookies and Special K Cereal are four new products to be introduced.

The company had an approved foreign equity of Rs 225 crore and RBI approval for payment of royalty till April 1991. The duration of the financial-cum-technical collaboration was stated to be 10 years from the date of agreement or seven years from the date of commencement of commercial production in the RBI approval. The Indian subsidiary was paying royalty at the rate of 8 per cent on exports and 5 per cent on domestic sales.

Kellogg India requested the FIPB to extend the period of royalty payment till March 2110 on the grounds that the parent company has been providing technical know-how in the form of secret formula, processes and manufacturing procedures.

As per extant policy, 100 per cent foreign owned subsidiaries are allowed to pay royalty without limit on the duration of payment. Moreover, the company's proposal is already permissible on the automatic route. Hence, the board has approved the proposal and has recommended the proposal for the Minister's clearance.

BIFR Directs MFIL to Submit Revival Plan

- **Punjab National Bank to assist MFIL in formulating revival proposal.**
- **74% in MFIL disinvested in 2000, remaining 26% to be disinvested now.**

Board for Industrial and Financial Reconstruction (BIFR) has directed Modern Food Industries Ltd. (MFIL), the first PSU where divestment process was initiated by BJP-led Government to submit an agreed rehabilitation package. Further, BIFR asked Punjab National Bank to assist MFIL in formulating revival proposal.

The Government not only disinvested 74 per cent in MFIL, in favour of Hindustan Lever Ltd. (HLL), during February 2000, but very recently Ministry of Disinvestment decided to divest the remaining government stake of 26 per cent in the company.

MFIL targeted to end 2001 with sales of Rs 220 crore, against Rs 150 crore in 2000. It was targeting to break even in two - three years. By then, the three-year lock in period, following disinvestments of 74 per cent equity of MFIL, would be over.

HLL Extends Farm Project, Commences Tomato Crushing Units

- **HLL's wheat farm project, extended from 250 acres to 1000 acres of land.**
- **Punjab and other wheat growing states under consideration for expansion.**
- **In Punjab, HLL commences experiment on crushing tomatoes.**

After the pilot farm project of wheat at Hoshangabad, Madhya Pradesh, Hindustan Lever Ltd. has made plans to extend this model to other wheat growing states. The farm project was initiated, in 1999, with 250 acres of land at Hoshangabad. Rallis India Ltd., its agricultural input provider, ICICI, the finance provider, and HLL, the procurer and end user have now extended the project to 1,000 acres. While they have an eye on Punjab, a major wheat growing state, they have interests on other wheat growing states as well.

In Hoshangabad project, HLL has made some savings in handling and transportation costs through direct procurement. Still, HLL stresses that the government needs to exempt it from some of the restrictions regarding procurement.

Through this project, HLL has been able to increase wheat productivity by 70 per cent and improve the cosmetic quality of grain. Improvements in the chemical composition of the grain is still a long way off and issues concerning defaults by individual farmers are yet to be tackled, as there are no enforceable rules in place.

However, within the food category, wheat is going to be a major initiative. A whole range of products in wheat is waiting to hit the markets from HLL.

Besides, in Punjab, HLL has commenced an experiment on crushing tomatoes, using mobile crushing units mounted on trucks, at the field to minimize losses. At present, three such units are working for HLL's Kissan range of products.

Cadburys Parents Holding Raised

- **14 m shares tendered in open offer at Rs 500 per share.**
- **Offer size of Rs 874.9 crore is the largest voluntary offer so far.**

After an open offer to the shareholders of the Cadburys India Ltd, its parent company Cadburys Schweppes' holding in Indian subsidiary has been raised to over 90 per cent. Nearly 14 million shares were tendered in the open offer at a price of Rs 500 per share. With an offer size of Rs 874.9 crore it was the largest voluntary offer made so far. However, the final holding will be confirmed after completion of documentary validation.

Now that Cadburys Schweppes' shareholding in its Indian company exceeds 90 per cent, it will make another offer at the same price within three months as per the SEBI Takeover Code. Cadburys Schweppes will take necessary steps to de-list Cadburys India from stock exchanges, once second offer is completed.

India being a key market for Cadburys, this transaction provides opportunities for value creation through closer integration.

CORPORATE-GLOBAL

argill to Launch Trehalose

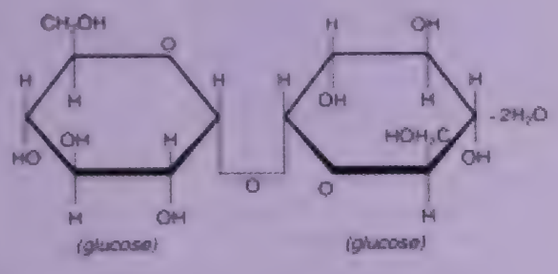
Trehalose, a sugar made from corn starch, occurs in plants and foods such as honey, lobster and yeast.

Has blunted insulin response compared to other sugars.

Cargill Health and Food Technologies, a unit of the US agri-business nt Cargill, is ely to introce a new sugar led trehalose. halose, is a e of sugar de from corn rch occurring urally in nts and foods ch as honey, ster and yeast. Recent dies have shown that it has lunted insulin response mpared to other sugars.

Trehalose may be digested and absorbed at a slower, sustained rate than other sugars. This means that the ingredient may provide more sustained energy with less sugar. Hence, it might prompt increased use of trehalose in sports drinks and nutrition bars. Trehalose has a wide range of applications ranging from nutrition bars, sports drinks, bakery products, ice creams and confections.

Trehalose Structural Formula



Tetley Bids Bye to its US Private Label Tea Biz

- **Harris Tea is the likely buyer with $ 15 million receipt.**
- **Debt equity ratio of Leveraged Buy Out continues at 1.75 : 1 during year-end.**

Tata Tea acquired Tetley plans to sell off its private label tea business in the US. Harris Tea, a player in the private label segment, is the likely buyer. A receipt of $ 15 million is expected.

An EBIDT growth of 24 per cent with cash accruals 2.6 times over previous year was seen helping Tetley to repay 8 million pounds of debt this fiscal from internal accruals. However, this did not include its earnings from sale of its private label business. The planned sale appears to be a subsequent development that TTL decided against Tetley divesting peripheral businesses.

Notwithstanding the sale and Tetley's further improvement in EBIDT growth to 34 per cent its debt repayment is following a set schedule. The expected debt equity ratio of the Leveraged Buy Out (LBO) continues to be 1.75 : 1 during the year-end.

30 million pounds infusion at Tetley, which TTL disclosed some time ago, including 20 million pounds from Tata Sons, remains as the significant debt reduction step. Of this, 26 million pounds was reported to replace high cost debt, put in at 7 per cent interest rate, replacing earlier funds costing over 17 per cent.

FOODGRAINS

atnam to Plunge into asmati Contract Farming

Contract farming of Basmati rice on 500 hectares of land in Punjab in next two years.

Range of heat-and-eat foods, including veg. meal, *parathas*, etc.

The Delhi-based Satnam verseas Group is pondering er entering contract farming Basmati rice. The company s plans to take up contract rming on about 500 hectares land in Punjab in the next o years. Subsequently, it ght scale up the acreage.

A range of heat-and-eat ods, comprising a whole getarian meal, including adymade *parathas*, will be troduced during March-pril. With an investment of er Rs 3 crore on value-added ocessing units, having a pacity to produce about 600 ns per hour, the company pects sales to grace Rs 30 re mark. Moreover, a range of branded and packeted spices is also on the anvil.

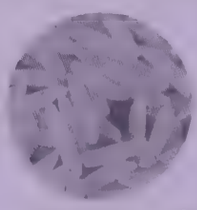
Having widened the product base, the company aims at an increase of Rs 50 crore in the turn over, during the coming financial year, through export and domestic markets. The Group feels that such products have strong export potentials in US, Europe and West Asia.

Alongside the introduction of new products, Satnam Overseas is consolidating its marketing network. In 11 centres, it has launched an incentive programme, 'Kohinoor Club' to reward retailers' performance and product loyalty. Only invitees and those retailers reporting sales more than Rs 10,000 per month of Satnam's brand of basmati rice will have entry into the club. Initially the programme would target 3000 retailers and by the end of the year 30,000 retailers would be covered.

Price Advisory for Basmati Exports

- **Government to advice exporters to ship Basmati rice at a fixed price.**
- **To ensure EU allows Basmati exports duty free and prevent exporters from playing mischief with quality.**
- **Check on shipments priced minimum 10 percent below base price.**

The government is considering implementing of a price advisory for export of Basmati rice, especially for shipments to the European Union (EU).



The price advisory will enable the government to advise the exporters to ship Basmati rice at a fixed price. This would be done through Agricultural and Processed Food Products Export Development Authority (APEDA), the agency that monitors rice export, in a bid to ensure that the EU allows all Basmati exports duty free. Besides, this would prevent the exporters from playing any mischief with Basmati shipments, particularly with regard to quality. Any shipment priced minimum 10 per cent below advisory price would be checked for quality.

While Indian premium Basmati is priced at $ 600-620 a tonne f.o.b., Pakistan Basmati is just $ 470-490 a tonne f.o.b. Hence, the price advisory would help face competition with Pakistan, which is reported to have inferior quality Basmati.

During January-July 2001, the Basmati prices declined to 4.05 lakh tonnes from 5.45 lakh tonnes in the previous year. It has begun to stabilize now. In 2000-01 fiscal, Basmati exports were 8.5 lakh tonnes, valued at Rs 2,165 crore, up from 6.06 lakh tonnes during 1999-2000.

APE, Stormor to Strive for Storage Solutions

- **APE and Stormor bid FCI tender to set up warehouses to store 18 lakh tonnes of foodgrains.**
- **Annually, India incurs 25m tonnes of foodgrain loss, costing approximately Rs 15,000 crore.**

After the opening up of storage and warehousing market in the last budget, the Bangalore-based APE Grain Systems has tied up with MFS/YORK/STORMOR of US for bulk grain handling solutions in India for the emerging storage and warehousing market. The two have bid the FCI tender to set up warehouses to store 18 lakh tonnes of foodgrains.

Bulk handling is a new concept in India. Till now, most of the grain storage was made in bags in godowns. The bagged storage not only requires more space and more labour but it involves 15-20 per cent wastage. Various studies have shown that the food grain losses in the country are nearly 25 million tonnes per year, which amounts to approximately Rs 15,000 crore. Annually, FCI incurs a loss of over Rs 300 crore.

Stormor offers storage solutions with capacities that range from 5 tonnes to 14,000 tonnes. In India, traders might want 10 -15,000 tonne silos, while farmers at the district level might need 5-10,000 tonnes. Even it can be broken down to panchayat levels.

Better storage means lower losses and also better quality maintenance, which also means better prices in the market. APE has inaugurated a model project. It has a few tonne silos on offer for use on a trial basis. Also, APE has set up storage facilities for mixed poultry feed.

ITC to Pounce into Rice Export Business

- **ITC wants FCI to waive the 1% market cess on paddy.**
- **Sets up Rs 35 lakh aqua laboratory at Kakinada for seed testing.**
- **ITC spends Rs 100 crore for promoting aquaculture in AP.**

ITC has expressed its desire to take up rice exports on a large scale if the Food Corporation of India (FCI) agrees to waive the one per cent market cess on paddy. It has stressed that such export incentives are necessary for farmers to get a good price.

Already the international business division of ITC is exporting rice, wheat, aqua products, fruits and oils from 14 states. Its total turnover amounts to Rs 750 crore. Though the exports through Vishakapatnam or Chennai prove to be more economical than that of Kakinada, ITC prefers to export wheat from Kakinada deepwater port in t near future.

The international business division of ITC has set up a Rs 35 lakh aqua laboratory at Kakinada for seed testing and other sophisticated tests to prevent the spread of disease most of the hatcheries in the state are situated in and arou the town. The farmers and hatcheries for a fee of Rs 1200 could use the laboratory. PCR (polymer chain reaction) and other tests will be conducted here and results would be provided in six hours or so. Also, ITC is spending Rs 100 crore in the state for promotin aquaculture.

Further, ITC is exporting boiled rice from Punjab as it is found to be superior to AP ric in quality.

OILSEEDS & VEGETABLE OILS

New Variants of Sundrop for Crisis Management

- **Global cutback in sunflower oil production and increase in oil tariffs render sunflower oil less competitive in Indian market.**
- **Sundrop Nutrifit and Sundrop Superlight are two new variants relaunched.**
- **Increase witnessed in f.o.b. price of sunflower oil from $ 335 per tonne in Jan 2001 to $ 550 in Dec.**

Following sharp rise in sunflower oil prices, ConAgra's Agro Tech Foods Ltd. has relaunched Sundrop, its flagship brand. With global cutback in sunflower oil production and increase in oil tariffs, the sunflower oil has become less competitive in Indian market when compared to other oils. Hence, Sundrop brand of sunflower oil is facing stress in volume and margin.

In this context, the company has relaunched Sundrop in two variants - Sundrop Superlight and Sundrop Nutrifit. Sundrop Nutrifit is a blend of sunflower and soyabean oil. This is cheaper by Rs 11 per kg compared to original price of Sundrop sunflower oil. Sundrop Superlight, is priced the same as before, but is claimed to be more refined and has improved packaging.

The f.o.b. price of sunflower oil increased from $ 335 per tonne in January 2001, to $ 550 in December. Similarly, the domestic export price grew from Rs 26,000 to Rs 41,500 per tonne during the same period. Consequently, sunflower oil has become the costliest edible oil in the country.

Recently, AFTL launched Healthy World Protein Power *Atta*, priced 10 per cent higher than the existing *atta* and stated to be containing more protein than other *atta*. Other than this, AFTL introduced "Chilly Surprise," a third new variant of ACT II popcorn.

Move to Canalize Edible Oils Import Condemned

- **'Back-door canalization' of imports of sunflower oil, rapeseed oil, mustard oil and colza oil through TRQ**
- **45% and 85% duty on imports up to and beyond 1.50 lakh tonnes respectively, in a financial year.**

The government has decided to introduce 'back-door canalisation' of imports of crude sunflower oil, refined rapeseed oil, mustard oil and colza oil through Tariff Rate Quota (TRQ) route. Under the TRQ regime, a customs duty of 45 per cent is chargeable on imports up to an aggregate quantity of 1.50 lakh tonnes in a financial year, and imports beyond this limit at 85 per cent.

For crude sunflower seed or safflower oil, duties have been fixed at 50 per cent and 75 per cent for imports not exceeding 1.50 lakh tonnes in a financial year and imports beyond this quota respectively.

As per the public notice issued by the Directorate-General of Foreign Trade (DGFT), imports of these oils would be exclusively routed through NDDB, NAFED and STCs. But reintroduction of canalization under TRQ imports through State agencie will discourage free market trade and in turn larger participation of private sector says a Vanaspati Manufacture Association of India. Further, canalization of import of thes oils through STC, NDDB and NAFED will deprive the industry of its legitimate righ as actual user, to import the right quality of oil at right prices.

Furthermore, the Association demanded that Vanaspati units, in their capacity as actual users, shou be allowed to directly import these oils under TRQ without going through the designated canalizing agencies.

FRUITS & VEGETABLES

PEDA to Boost Mango Exports

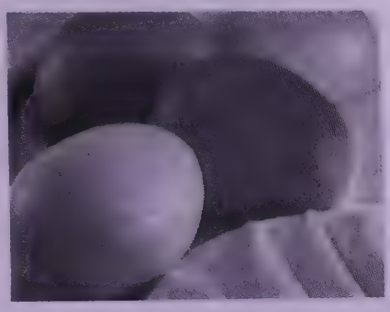
Focus on mango and mango products in FHA 2002.

APEDA to develop technology that will give mango a longer life.

Mango exports expected to touch Rs 100 crore this year.

In the 13th Asian International Exhibition of Food and Hospitality (FHA 2002), Singapore, the Agricultural and Processed Food Export Development Authority (APEDA) will throw focus on Indian mango in a big way, APEDA is expecting mango exports to touch Rs 100 crore this year.

Mangoes and mango products such as pulp concentrates and pickles would receive greater thrust in the exhibition. Apart from the Alphonso variety, other varieties such as *Banganapalli, Suvarnarekha, Kesar* and *Chausa* will be introduced in a phased manner. The mango varieties and products will also be introduced in UK, France and West Asia.

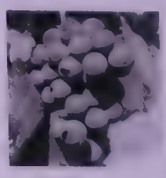


India has the largest mango export share in the world i.e., 53 per cent, which is roughly 10 per cent of our production. Deplorably, 20-30 per cent of mangoes grown in the country are lost due to improper pre- and post-harvest care. Hence, APEDA is in the process of developing a technology that will give mango a longer life, so that it can be shipped instead of flown to export destinations.

APEDA will showcase rice, honey, groundnuts and ethnic foods in FHA 2002, to be held during April 9-12. It will take up 78 sq metres at the exhibition along with 18 domestic companies. About 2,650 companies from 66 countries will participate in FHA 2002. It expects to host 35,000 trade buyers and already has 5,186 pre-registered visitors with a purchasing budget of $ 1.9 billion.

APEDA's Grape Centre in Europe

- **20,647 tonnes of fresh grapes exported to Europe last year.**



Following the good response to the marketing centre for cut flowers at Amsterdam, APEDA has planned to set up a marketing centre for grapes in Europe, which is the biggest market for Indian grapes. During last year, India exported 20,647 tonnes of fresh grapes to Europe, valued at Rs 83 crore. However, the location of the centre is not yet decided. A sharp shift in the approach, from inward looking to market oriented, is seen in APEDA. Hence, APEDA will focus more on markets, see the requirement there and change the parameters here.

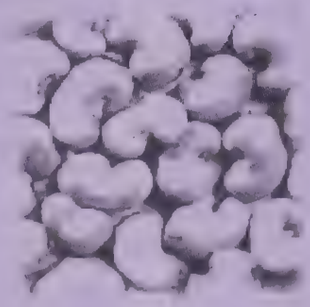
SPICES & PLANTATION PRODUCTS

Cashew Production Expected to Exceed 4 Lakh Tonnes

- **Congenial weather conditions, low pest damage level, good flushing and flowering to result in a better crop this season.**
- **Productivity per hectare is around 1,200 kg in Maharahtra, 850 kg in Kerala.**
- **Maharashtra state government has launched home-scale processing programme on cashew with a subsidy of Rs 25,000.**
- **Maharashtra's cashew production estimated at 1.32-1.4 lakh tonnes for the current season.**

During the current season, raw cashewnut production in the country is set to cross four lakh tonnes. As weather conditions are congenial, coupled with low pest damage level, good flushing and flowering a better crop is expected.

Last year, the production stood at 3.6 lakh tones with Maharashtra overtaking Kerala in terms of area and production. The Cashew area in Maharashtra has been showing a steady growth. Even the productivity per hectare was around 1,200 kg compared 850 kg in Kerala.



For the current season, the production of Maharashtra is estimated around 1.3 to 1.4 lakh tonnes. Kerala's output is expected to be less than one lakh tonnes, followed by 0.7 lakh tonnes in Andhra Pradesh.

Although Andhra Pradesh has 1.2 lakh hectares dedicated to cashew, its production is comparatively less owing to low soil fertility, relatively low rainfall and frequent cyclones inherent to the eastern coast.

Unlike other cashew growing states, Maharashtra has 180 registered multipurpose nurseries, producing 60 lakh plating materials of high yielding varieties per annum. Of this, 50 per cent is sold to other states.

The state government has launched a home-scale processing programme to ensure moderate price for raw cashewnuts, apart from generating employment for rural women. Already 400 home-scale processing units have come up in this area, involving investment of Rs 50,000 per unit, with installed processing capacity of 0.5 tonne per day. The state government is providing a subsidy of Rs 25,000 for this purpose.

Further, the Food and Agricultural Organisation (FAO) has identified cashew kernel as an item that could ensure nutritional security for women and children. This phenomenon could increase the per capita consumption of cashew in India and abroad.

MEAT, POULTRY & SEAFOODS

TN Chick Producers to Follow Lankan Model

- **TN chick producers plan to shift from live-bird production to processed chicken production/marketing.**
- **Move likely to stabilise selling prices of chicks and streamline distribution.**

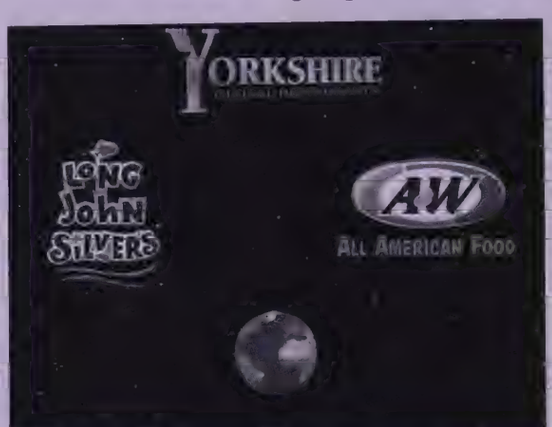
Tamil Nadu's chicken producers are planning to shift from live-bird production to processed chicken production/marketing. The move is likely to benefit the state's broiler producers in stabilising selling prices of chicks and streamlining the distribution.

The major broiler producers in the state, under the auspices of the state Broiler Co-ordination Committee (BCC), will have a closer look at the Sri Lankan model, whose chicken marketing is said to have transformed itself into a frozen chick meat market from being a live-bird selling in a matter of eight years

US-based YGR Brands to Enter India

- **Long John Silver, A&W are two YGR brands likely to enter India.**
- **Ansal Group allocates Rs 60 crore for setting up YGRs in Northern and Western India.**
- **YGR is the 14th largest US based restaurant chain.**

Yorkshire Global Restaurants (YGR), the US-based $ 1.2 billion seafood chain, is holding talks with the Delhi-based Deepak Ansal Group for a tie-up to bring two of its flagship brands to India. Long John Silver, a quick service franchise restaurant chain and A&W, America's largest quick service seafood restaurant chain, are the two restaurant brands likely to enter the Indian market.



The Ansal Group has set aside an investment of nearly Rs 60 crore for setting up these restaurants in Northern and Western India.

The Yorkshire Global Restaurants chain, an 80-year old quick service restaurant chain, operates over 2,000 restaurants across 16 countries. Currently, YGR, owned by a group of investors including Grotech Capital, is the14th largest US-based restaurant chain.

Last year, YGR introduced a global information system with the objective of identifying potential sites for setting up new restaurants.

African Meat Market Opens Up, India Optimistic

- **APEDA eyes at Africa for exporting domestic meat products.**

The recent lifting of ban on meat exports by Egypt and Jordan might provide good opportunities for Indian meat exports. Hence, APEDA is eyeing Africa to export meat products from the country. In the background of increase in demand for meat products in the region, India has a major chance for meat exports.

While there was a slowdow in exports in the first three to four months of the past financial year owing to the ban on exports by Egypt and Jordan following mad cow disease (BSE), with the recent lifting of ban exports have started picking up. However, trends indicate that meat products from the country are likely to remain at last year's level.

Last year, the animal products accounted for 18 per cent Rs 1,637 crore, for overall exports of agricultural and processed food products of Rs 9,212 crore.

SNACK FOODS

Aa Ja Kha Ja..... Accha Hai, Saccha Hai !

- **Mother Dairy and Bikanerwala have a tie over *namkeens*.**
- **Five flavours in 35 g and 200 g pack sizes at Rs 5 and Rs 21 respectively.**

Mother Dairy Fruit and Vegetable Ltd., a 100 per cent subsidiary of the NDDB, has forayed into snacks segment with the launch of *'Aa Ja Kha Ja.'* The Delhi-based Bikanerwala foods will manufacture *namkeens* that will be marketed by Mother Dairy Fruit Vegetable Ltd.

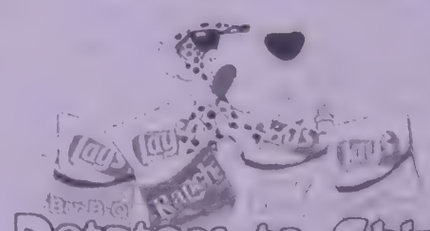
Initially, *namkeens* will be available in five flavours with 35 g and 200 g pack sizes for a competitive price of Rs 5 and Rs 21 respectively. It will make use of *'Accha Hai, Saccha Hai !'* tagline, the punch line for Safal and will be available at Safal and Mother Dairy booths across Delhi.

For the past one year, Mother Dairy is steadily increasing its reach amongst different processed food segments. Apart from dairy-based items such as ice cream, lassi, yoghurt, the Safal network of products comprises peas, rice, fruit drinks, ketchup, jams, pickles and squashes.

Lay's Chips Lays Hands at Youth

- **Reintroduction of Lay's Chips with differentiated taste, appearance, texture and packaging.**
- **Move aimed at changing brand perception from kiddie product to an aspirational youth icon product.**

Frito-Lay India will reintroduce Lay's Chips, its salty snack product, with differentiated taste, appearance, texture and packaging. The existing brand perception of Lay's as a kiddie product is to be transformed to an aspirational youth icon product through this exercise.



Frito-Lay India's manufacturing plants at Channo in Punjab and Ranjangaon in Maharashtra have installed state-of-the-art equipment.

While potatoes are grown through the company's agro programme in Punjab, UP, MP, Karnataka and Maharashtr a consumer level promo tion campaign 'Lay's Best Chip Challenge', in association with *hungama.com*, is on the drive a the other end.

DAIRY & DAIRY PRODUCTS

mul Infant Formulas Launched in North East

Infant Formulas, based on CODEX and PFA specifications, and meeting WHO and BIS standards launched.

Priced at Rs 105 per 500 g tin, they contain whole list of additives prescribed for babies.

Amul Infant Formula 1 and Infant Formula II, based on CODEX and PFA specifications, and also meeting WHO and BIS standards, were launched recently in the North Eastern region.

The products priced at Rs 105 per 500 g tin, contain the whole list of additives prescribed for babies. Amul claims that these products are the best options for babies whose mothers are unable to breast-feed because both the formulas follow the composition of mothers milk in terms of amino acid profile.

Moreover, they also contain the recommended amounts of essential fatty acids such as linoleic acid, essential micro-nutrients for growth promotion such as taurine, carnitine, choline and inositol, perfect balance of minerals - iron, copper, zinc, iodine, adequate vitamins A, D, C, B6, B12, thiamine, riboflavin, niacin and folic acid - and improved digestibility with reduced lactose content.

CONFECTIONERY

mul to Venture into Branded Sugar, Ready-to-Drink Coffee Segment

Negotiations with NFCSFL for sourcing sugar.

NFCSFL to supply sugar in packaged form, to be sold through Amul's wide distribution network.

Amul mulls at supplying coffee, premixed with milk powder and sugar, through vending machines.

The Gujarat Co-operative ilk Marketing Federation CMMF), known for its Amul and, is planning to foray into e branded sugar segment, hich consists of players like odi and Dhampur. The dairy ajor is negotiating with the ational Federation of Co-perative Sugar Factories Ltd. (NFCSFL) for sourcing sugar. The sourced sugar will be sold under Amul or any other suitable brand name.

NFCSFL represents the interests of co-operative sugar mills, which accounts for around 55 per cent of total sugar produced in the country. As the Government is reducing levy ratio of sugar from NFCSFL from the earlier 40 per cent to 15 per cent and is keen on withdrawing from market altogether, NFCSFL has the need to explore alternative avenues to sell sugar.

NFCSFL is willing to supply sugar in packaged form, which can be sold under Amul brand through its extensive distribution network of 2000 distributors and five lakh retailers across the country.

Also, Amul has plans to enter ready-to-drink coffee segment. It is not interested in selling plain coffee beans or powder to the retail consumer. The cooperative views coffee primarily as a vehicle for pushing its milk sales. Hence, it is looking for a formula by which coffee and milk can be sold together to the consumer.

Amul is weighing at the option of sale of coffee through vending machines that could be manually operated at the retailer's end. The coffee, in a premixed form along with the milk powder and sugar, may be supplied to the vendor. However, the co-operative ruled out setting up of exclusive retail parlours for sale of Amul coffee in the lines of Nestle and Barista.

BEVERAGES – NON-ALCOHOLIC

etley Desires Vending achines at Strategic Places

Vending machines at airports, up-market shopping malls and complexes.

Product appeal for a premium mindset, supported by advertising campaign.

In order to extend the istribution of Tetley, ata Tea will place vending achines at airports, up-arket shopping malls, omplexes and so on.

After a year and a half of ying out various combina-ons of teas from various regions in the country and abroad Tetley blend was chosen. Tetley will appeal for a premium mindset and would be supported by a national-level advertising campaign. After gaining some market presence, it would be extended to vending machines.

In the past three months, Tata Tea has launched two products in the bulk tea market and three consumer products - Temptations, Tetley and a variant of Agni-Sholay for the lower end of the market.

Rasna Targets to Reach One Billion Homes

- **To raise per capita consumption to 100 glasses from existing 15 by 2003.**
- **Strategy recast with Rasna leaf, song and reinvented Utsav brand.**
- **Aims mass visibility, affordability, proximity and availability across the country.**

Rasna Ltd. has set a target to reach out to one billion homes every year and to raise the per capita consumption to 100 glasses from the existing 15 by 2003.

Rasna's corporate strategy has been recast with Rasna leaf, song and reinvented Utsav brand. The logo portrays freshness, naturalness, health, youth, dynamism, taste and appetite. The central concept is *"Relish a Gain"* that symbolises health benefits and thirst quenching quality. The new strategy aims at mass visibility, affordability, proximity and availability across the country.

N-Joi! Two More Flavours

- **National roll-out of N-Joi by March.**
- **Frooti, to be extended to orange and pineapple flavours.**
- **Backward integration of Bailey, production of preforms and caps.**

Rs 300 crore Parle Agro Pvt. Ltd. has opted for product expansion in its various business segments. After its Alphonso mango and milk offering N-Joi, Parle Agro is planning to introduce two more fruit flavours including strawberry.

N-Joi's success in Mumbai and Chennai, has also paved way for its national roll-out by March end. Launched in October 2001, N-Joi mango has captured 24 per cent of the market share in milk-based beverages.

For 2002, Parle Agro has set aside an advertising budget of Rs 10-12 crores, primarily for N-Joi, which is due to be launched from March 2002.

In the fruit drink segment, where Parle Agro has the popular "Mango Frooti" brand, it has plans to extend to orange and pineapple, under the same brandname Frooti. While the orange pulp will be imported from Brazil, the pineapple will be sourced from Thailand.

Frooti Mango, having 85 per cent market share in tetra packs, grew by modest four per cent in 2001, against an average growth of 18-20 per cent.

As for Parle's mineral water business, Bailey, Parle Agro is going for backward integration and has gone into the production of preforms and caps. In this segment, the company has gone into packs of various sizes from 20-litre bulk packs to 200 ml pouches and bottles and 150 ml cups.

Railways will Cater Railneer

- **IRCTC to manufacture and supply bottled mineral water.**
- **30% and 20% of water samples of Northern Railways and all-India level respectively are substandard.**
- **Option of marketing Railneer outside stations, trains not foreclosed.**

The Indian Railways has decided to enter the estimated Rs 1,000 crore bottled water segment. Indian Railway Catering and Tourism Corporation (IRCTC), will venture the market under its own brand name - Railneer.

The mandate for manufacture and supply of "pure quality" mineral water was given to IRCTC by none other than the Railway Minister, Nitish Kumar, following complaints on quality of packaged water sold to the rail commuters and at railway stations.

Quality checks on Northern Railways revealed that at least 30 per cent of water samples were substandard. At the all-India level, nearly 20 per cent of the samples were defective.

Railneer's entry will not only meet the basic requirement of rail commuters but also could earn extra revenue for IRCTC. There is hardly any estimate of the number of mineral water bottles sold at stations. This could run into few lakhs. The number works out to be around 1,000 and 1,400 on Shatabdi and Rajdhani respectively.

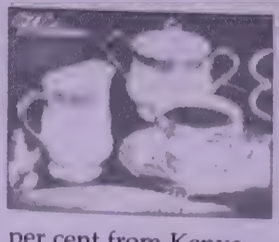
The plan involves identifying railway land, checking out the water quality on these lands and tying up with the equipment manufacturers. The railways reckons that the venture would turn out to be a money spinner. Neither is the option of marketing Railneer outside stations and trains foreclosed, if the business proves to be lucrative.

It takes about 200 odd brands to service all the trains across the country. Railneer will be substituting other brands.

Tata Tea Expects Enhanced Export Growth

- **Acquisition of Tetley will provide international access to Tata Tea and give TTL an international brand for Indian market.**
- **Latest trend worldwide shows tea consumption will increase in view of it being promoted as a health drink.**

After the acquisition of UK-based Tetley, Tata Tea Ltd (TTL) is expecting an overall growth in tea exports of both Tetley and Tata Tea. The total annual requirement of Tetley is more than 50 m kg of raw tea. Of this, 14 per cent is procured from India and 35 per cent from Kenya.



Though Tetley is a subsidiary of TTL, it would maintain its individual entity and both the companies would complement each other as the integration takes place. Acquisition of Tetley has provided double benefit to Tata Tea by providing international access to TTL and giving it an international brand for Indian market.

Moreover, the latest trend worldwide shows that tea consumption will increase in view of it being promoted as a health drink in the West. In fact, the growth of alternative categories such as ready-to-drink, flavoured tea, health and neutraceutical tea and life style options of vending are reversing the previously stagnant and declining consumption of tea in traditional markets.

Indigenous "Sparkling" Water from UB

- **Sparkling water, a milder form soda, to be a premium brand of UB and an ideal mixer for UB's liquor brands.**
- **Like water and soda, sparkling water will be used for brand recall.**

After water and soda, UB Group's Rs 1,500 crore spirits division is thinking of extending its product line to sparkling water as well. Nestle and Evian are already the players in the Indian market. The move is significant in the context of ban on liquor advertising and the non-existence of indigenous national brands. McDowell's water and soda brands are being used for brand recall of UB's liquor brands.

The sparkling water, a milder form soda, will be a premium brand of UB Group and also an ideal mixer for all the brands under the company. Sparkling water is yet to emerge as an acceptable category amidst Indian consumers. It is still nascent in India with just a handful of directly imported brands.

Presently, there is a limited market for the product. Hence, UB has decided to get its brand bottled by few of its bottlers. However, in view of the premium nature of sparkling water, the product would be attached to one of its premium brands, which could possibly be McDowell's Signature Whisky.

The spirits division runs its water and soda business purely through franchise operations and its beer division. Recently, it has forayed into sales through the Net.

hort-term Government Assistance for Tea Exporters

Rs 2.50-3.50 assistance per kg for orthodox and packet tea exporters, during January-March.

Government to reimburse social costs spent by the industry.

During January-March 2002, orthodox and packet tea porters will get market velopment assistance from Union Commerce Ministry. e ministry will provide an sistance of Rs 2.50 - 3.50 per to the orthodox and packet tea exporters, for boosting the slacking tea exports.

The three-month long scheme aims at restoring tea exports to last year's level and is likely to be withdrawn after that is achieved. The assistance will be given for market access initiatives and will help exporters find new markets and quality packaging their products.

For quite some time, the organized tea industry has been making claims that its high production cost is primarily due to the piling up of social expenses like education, and other living costs of workers in the Northeast. The government has agreed to reimburse these expenses and has directed the industry to provide a clear statement of the social costs involved.

However, the industry's complaint against small growers and bought leaf factories on different counts were rejected on the grounds that this particular section of the industry was a reality and the organized sector should try to create a partnership with it for the larger interests of the industry. The Tea Association of India, during its 38th Annual General Meeting at Kolkata, has urged the government to increase import duty on tea from 70 per cent to 150 per cent, abolish central excise duty and reduce existing sales tax of eight per cent by shifting tea from the general goods category to the essential goods list.

BEVERAGES – ALCOHOLIC

nternational Castle Beer Knocks Indian Capital

Available in 650 ml, priced at Rs 35, and 330 ml, priced at Rs 20.

SAB desires to acquire a 10% share in beer segment in first year.

Targets age group of 25-40 years.

South African reweries India Ltd., subsidiary of South frican Breweries, as launched ternational brand astle Lager in Delhi.

The beer will be vailable in pack sizes of 650 l, priced at Rs 35, and 330 ml, riced at Rs 20 in retail outlets, bars and restaurants. In the very first year, SAB has hopes to acquire a 10 per cent share in the beer segment.

The indigenously brewed beer targets the age group of 25-40 years. The company's marketing initiatives will be focussed on innovative promotions for consumers and will also try to establish an association with sports in India.

Three Lions, Knock Out, Continental, Bengal Premium are already in SAB's portfolio in the country.

New Dimension from 100 ml IMFL

- **Sales of 100 ml bottles expected to cross 1m cases in March.**
- **100 ml bottles are pegged at Rs 15 per unit.**
- **MBDL's *Red Bull*, Empee Distilleries' *Power*, Balaji Group's *Singham*, Shiva Distilleries' *Pick Up* and Safil's *Superstar* are the new brands in 100 ml category.**

Tamil Nadu's liquor sale has acquired an added dimension after the government's nod, in late last year, to introduce 100 ml bottles of IMFL liquor. In January, the month of introduction, combined monthly sales of 100 ml bottles touched five lakh cases. The industry expects the sales to cross one million cases in March. It is to be noted that so far the state's monthly liquor sales hovered around just 1.2 million cases. The 100 ml bottles are pegged at an affordable price of Rs 15 per unit.

The government's move has to be seen in the background of its revenue maximization plan by tapping the existing potential in the low-end market. Only local distilleries were allowed to hit the market with new packs. All five TN-based distilleries have come up with new brands in the 100ml category. MBDL's *Red Bull*, Empee Distilleries' *Power*, Balaji Group's *Singham*, Shiva Distilleries' *Pick Up* and Safil's *Superstar*. The distilleries investing on new 100 ml bottles expect indirect gains to accrue from economies of scale as production lines and volumes move up.

News & Analysis section compiled and edited by Poarkodi N, Daniel VA, Raghavan I and Rangarao GCP

Announcement

Indian Food Industry is a widely read trade and technology journal with a wealth of useful information relevant to food industry. Of late, the cost of bringing out this popular publication has gone up leaps and bounds due to which the Association is put into severe strain. To overcome this situation, the Central Executive Committee of the Association in its last meeting took a decision to revise the subscription rates marginally with effect from 1 January 2002, as follows.

1 Year	Rs	500/-
2 Years	Rs.	900/-
3 Years	Rs	1,350/-

Cooperation of our esteemed readers is solicited.

Editors

TECH REVIEWS

Infrastructure Development for Effective Marketing of Fresh Fruits with Reference to Packhouses

P. G. Adsule

ICAR Research Complex for Goa, Ela, Old Goa 403 302

The North Eastern region comprises seven states — Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura and is bound by Bangladesh, Myanmar and China. The region produces a whole range of horticultural produce besides plantation crops, spices and herbs and much of which could be processed and exported to the rest of the country and worldwide.

Following is the Agro potential of the region in brief.

Horticulture

Fruit production of North Eastern region is around 21.12 lakh tonnes which account for 5.5 per cent of the country's total production, while the vegetable production is estimated to be around 33.87 lakh tonnes which contributes 5 per cent to the total production of the country.

Major fruits grown include banana, citrus fruits including orange (21%), and pineapple (19%) besides other fruits like jackfruit, apple, litchi, guava, papaya, mango, plum, peach, peas, passion fruit and other rare fruits like hatkola. Major vegetables grown in the region include potato, cabbage, brinjal and tomato grown. Spices include ginger, turmeric, chillies and large cardamom which has a major share.

Floriculture and the Existing Horticulture Crops

Medicinal and aromatic plants of the region mainly include begonia, chrysanthemum, cineraria, dhalia, aster, gladioli, roses, lillies and carnation besides the storehouse of about 700 species of orchids, mostly wild. The region has a vast reserve of medicinal and aromatic plants, which include citronella, tung, agar and lemon grass. Citronella and tung have potential to be cultivated as important substitutes while agar has good potential for export.

Processing of Horticultural Produce

This sector has tremendous scope in the region. Currently, fruit-processing industry employs around 1000 persons at plant and marketing levels in the existing 51 FPO registered units with annual capacity of 7500 MT. However, the capacity utilisation varies from 1 to 35% as against an average of 40% in other parts of the country. This is mainly because of absence of linkage between the growers and processing units and the market. The inadequate working capital of procurement, high cost of transport and packaging material besides their non-availability in most of the small and tiny units, inadequate quality control facilities and more importantly, the lack of aggressive and planned marketing and post-harvest management have hampered the progress. There are no packhouses or cold storage facilities in the region for holding the surplus horticultural produce for domestic and export markets, further contributing to poor growth of the industry.

With well-organised marketing efforts under a common brand name for the regional products, the competition from well-established national brands can be met, which in turn, can result in a better economic breakthrough for the region.

Despite the region having a high potential, the overall development is far behind due to lack of infrastructure facilities like transport, communication, power and post-harvest storage. The existence of middlemen on the supply line, lack of modern methods of cultivation and the non-availability of branded products locally make the situation more difficult. Export opportunities exist for both fresh and processed products with the three nations of China, Myanmar and Bangladesh on the border of the region besides the growing market in the urban India.

There is a tremendous scope to increase the farm productivity per unit area with required quality if farm practices are improved. With well-organised marketing efforts under a common brand name for the regional products, the competition fror well-established national brands can be me which in turn, can result in a better ecc nomic breakthrough for the region.

An orientation towards the market by th producers can be considered to have severa elements. It implies that all activities unde taken throughout the marketing system ar aimed at meeting the needs of both the cor sumer and the producer. Only by satisfy ing those needs can marketing be profitabl For marketing to be effective, all factors i the system must make a profit. This in turn implies that changes to marketing or pos harvest techniques will only be viable whe they provide the necessary profit incentiv to participants in the marketing system. F nally, the marketing system is an integrate whole. Changes in one part, e.g. making change in packaging or additional stor cannot be planned in isolation from the t tal functioning of the system.

Many past interventions in the post-ha vest sector have failed because, whilst b ing technically correct, they have not bee planned with reference to market needs an its ability or willingness to pay for the su posed improvements. Improved post-ha vest management can often be brougl about by relatively small actions at sever stages in the production/marketing chai Willingness to examine the total food sy tem is thus a pre-condition for successf post-harvest work. Emphasis has to be a ways placed on identifying ways to ensu that post-harvest intervention is both pro itable and sustainable.

Production increases lead to even great increases in the marketed surpluses, cau ing the supply of food to the marketi system often to exceed the capacity of t system to handle it. While quantifyi losses, time is often a temptation to c "worst case" figures to dramatise the pro lem and thus extrapolations from limit samples to produce countrywide figures a used and many have exaggerated the ti picture. Researchers rarely attempted quantify the extent to which the losses cou be economically avoided. Introduction processing facilities with limited examin

of the market potential for the proc-
d products or even of the availability of
cient supply of the raw materials for
economic operation of the processing
ity will be a failure.

sound market approach implies iden-
ng consumer needs and seeking profit-
ity to satisfy them. Such an approach is
ntial if the food system stretching from
farmer to the consumer, is to function
ctively. As government gradually liber-
es the economies and permits increasing
olvement of the private sector in food
rketing greater is the need for post-har-
t improvements to be conducted within
arket framework group. Thus, there is
v an increased requirement for market
ented post-harvest support by technical
cialists.

oduction for the Market

Fruit losses stem both from poor post-
rvest handling and from overproduction.
order to avoid wasteful overproduction,
ivities to reduce post-harvest losses
ould begin even before the crop is
nted. Production should always be
ntered on such crops, and varieties in
preciable quantities for which market has
en identified. On occasion when total
rvest and marketing costs are likely to
ceed the market return, it is better to
ough back the crop into the ground or
herever possible use it as animal feed.
is has happened many times in case of
mmodities like onion in Maharashtra.
od loss may be preferable to a financial
ss in such cases. Emphasis on food-loss
evention in recent years particularly in
rticultural purchases has perhaps in-
eased pressure on Governments to "do
mething" and this has led for exchange to
uts of produce being stored with no mar-
t prospects. Processing factories were
ilt to utilize gluts of fruits and if they
erate way below capacity they will even-
ally become idle and economically
viable.

Some crops lend themselves to long-term
orage, which offers the potential to in-
ease the value of the product. For some
uit and vegetable crops, however, sales
ust be carried almost as soon as the pro-
uce is harvested. If demand is limited or
the farmer has poor access to the demand,
e losses are inevitable. Such losses can
nly be avoided by more effective produc-
on planning.

Production decisions which have an im-
act on post-harvest management and food
sses relate to following questions about
range and pineapple production for which
e infrastructure development for effective
arketing with reference to packhouses is
aborated below point wise.

(i) Which crops to grow (ii) Which vari-
ies to grow (iii) How much to grow (iv)
hen to grow (v) When to harvest, and (vi) Where to grow ? All these questions are related to capacity of market to provide an acceptable return for the producer's efforts.

Which Crops to Grow ?

High prices in one year encourage farmers to overproduce. The resulting gluts led to low production and high prices in the following season, which in turn lead to yet more gluts. In this situation, improved market information and knowledge of marketing by extension workers as well as improved post-harvest technologies can help to overcome the problem of alternate gluts and surpluses.

Which Varieties to Grow?

The effects of seasonal gluts can be reduced by the production of a range of varieties like early and late types, which extend season. However, profits will only be achieved if the varieties used produce reasonable yields and find acceptance with consumers. Some varieties also have more acceptable post-harvest characteristics than others since they can be stored for longer and thereby lengthen the period of the crop for the consumer. However, the consumer response for such produce in respect of their purchasing power has to be seen in this context.

Varieties of Citrus Fruit Excluding Grapefruit Group in the World

I. Major commercial varieties of oranges grown in the world are categorised into (i) Early (September to December) - 'Hamlin', 'Parson Brown', 'Mars'; (ii) Early midseason (October - November)-Navels ('Washington' Group); (iii) Midseason (December to February) - 'Pineapple', 'Seedlings', 'Jaffa', 'Homosassa', 'Queen' and (iv) Late (February to May) -'Valencia', 'Lue Gim Gong', 'Pope Summer'.

However, 'Valencia' is the most popular variety in the world in Mandarin group due to its following features:

High total soluble solids, deep rind and juice colours, seedless, medium texture, oblong to round shape, often regreens after growth starts in spring (when weather is warm and wet) holds well on tree after maturity, medium to large size, and numerous strains.

II. In speciality fruits similar to our Mandarin group is: 'Nagpur', 'Coorg' and 'Khasy' are (i) 'Temple' (tangor) (ii) Tangerines 'Ponkan', 'Clementine', 'Robinson' (Hybrid) 'Honey' tangerine (iii) Satsumas (iv) Tangelos (Tangerine grapefruit hybrid), 'Nova', 'Minneola', 'Thornton', 'Seminole' and (v) 'K- Early'.

However, among these groups, Dancy tangerines is main commercial variety (December to January) with high TSS and acid, erratic size (often too small); oblong to pyrioform shape deepness and uniformly red colour, texture often rough, becomes puffy late in season, and ships poorly. In Satsumas group 'Owari' only commercial variety (September to October), often at peak edibility before rind has degreened, low to medium, total soluble solids and low acid, medium size, rough to smooth, seedless, subject to scabes and ships poorly.

III. Acid Fruits

(i) Lemons : about 40 cultivars of which 'Bearss' is the principle cultivar in Florida, grown mainly for processing but comparable in colour, flavour, acidity and juice content to California fruit when carefully cured for fresh market and

(ii) Limes : 'Persian' ('Thiti', 'Bearss' is large, seedless, grown for both fresh market and processing. 'Key' ('Medican', 'West Indian') : small seeded, not grown commercially in Florida.

Use of some growth regulators in both the fruit is also possible to extend the harvesting period of fruits on the tree (Tree storage).

How Much to Grow ?

Farmers producing horticultural produce for the commercial market and which has more perishability is always at high risk. Too often, the investigation of market demand is rudimentary. Forecasts may be based on urban market prices with insufficient attention being paid to quality aspects, transport availability and market costs.

When to Grow and Harvest?

In fruit crops like citrus and pineapple, this has to be examined by staggered harvesting method using some growth regulating chemicals. Farmers are waiting for such opportunities. Both the fruits being of non-climatic nature, ripening of fruit after harvest is not the problem but spoilage by microorganisms through wounds is a major problem. All this could be prevented using appropriate permissible fungicides and following the temperature management at lower level.

Where to Grow ?

Studies of post-harvest losses have often given "insufficient transport" as a reason for such losses. However, governments, in their efforts towards increasing incomes of the poorest farmers to address question of marketing costs and availability of suitable marketing channels and infrastructure. Consideration of locational aspects can have an important impact on extending produce availability and reducing gluts. Thailand for example, can grow onion in three different areas within an altitude range of 800 meters. These provide three different harvests which when combined with simple types of post-harvest storage permit onion availability for nine months of the year.

Economically Viable Loss Reduction

With horticultural produce, will it be possible to fill a new cold store or will it only be used at 25 per cent capacity or will new plastic container be used once a week, or once a month, will some of the questions often arise. It is also essential to consider the impact on other marketing costs of changed post-harvest practices. Many a data for losses are estimates rather than actual measurements and are often based on extrapolations from small samples. Handling improvement activities for horticultural produce must generally be targeted initially at the top of the market where there is a greater awareness and willingness to pay for quality. It seems sensible to work with traders supplying supermarkets rather than with those selling in ordinary urban markets.

Handling improvement activities for horticultural produce must generally be targeted initially at the top of the market where there is a greater awareness and willingness to pay for quality.

For horticultural produce, the quality benefits of improved post-harvest handling techniques often only show up at the retail stage or when the consumer sets the produce house. If consumer suddenly finds that they can keep fruit for three to four days instead of previous one to two days, they may, overtime, be prepared to pay more for those fruits. Improvements, which are introduced at the top end of a consumer market, are more likely to achieve success in the short term and thus demonstrate benefits to the marketing system. Many modern post-harvest techniques for horticultural produce are expensive, requiring a high initial investment on an imported equipment. They also require highly trained staff and managers and immediate access to spare parts and skilled technicians. As an example, cool chain required specialised refrigerated stores close to the production areas to remove crop field heat as well as refrigerated transport vehicles. Produce, once stored in a refrigerated container should then be refrigerated all the way to and in the retail shop. The cost can usually only be justified when an integrated chain is established, only when there is highly developed infrastructure (good roads, reliable electricity), when there is a skilled work force and most importantly when there are consumers prepared to pay high price.

Post-harvest Improvements and the Marketing System

Product Standards

Attempts are on through BIS to introduce horticultural produce standards, but these have often failed as a result of lack of recognition of the nature of the market and then marketing system. Where bulk of consumers is relatively poor, use of elaborate standards of quality, size and maturity can be counter-productive. It may lead to higher consumer prices and an increase in food loss as a result of the inability to sell produce which fails to meet necessary standards. At times of storage, consumers will accept qualities which would be not acceptable in times of surplus. Consumers with little money are unlikely to be overly concerned with the size of the produce or whether it has physical blemishes. Where standards are felt to be necessary, they must be framed to allow marketing at all quality levels to satisfy all consumer groups. Standards are most effective where they are simply a codification of existing informed market practices or where they are aimed solely at the top end of the market. Application of standards for horticultural produce to be sold through NDDB fruit retail shops or supermarket may benefit both the consumer and the farmers, whereas standards to local retail or street markets may benefit neither. However, with the awareness of consumer and more purchasing power, this could be taken in future for quality products.

Application of standards for horticultural produce to be sold through NDDB fruit retail shops or supermarket may benefit both the consumer and the farmers, whereas standards to local retail or street markets may benefit neither.

Grading never improves quality, it merely separates qualities and only on the basis of size and this is done by small retail shop or wholesaler or producer himself to fetch a better price for his produce. We have "AGMARK" standards in this country which are of voluntary nature, could be taken as guidelines for grading citrus and pineapple fruits.

Storage

The tendency to see technological solutions to post-harvest problems while failing to consider economic, social and managerial aspects is all-too-apparent in the case of storage. There are many examples of stores constructed with best of intentions that now lie idle or are used for other purposes. A common view is that, in times of oversupply, produce can be held in storage and marketed when price rises occur. However, much horticultural produce is only suitable for short-term storage i.e., a few days or so. This is rarely long enough for prices to rise, when produce is brought out of store, it may have lost freshness and quality and has to compete with fresh produce. Prices r ceived may be reduced and storage costs a incurred. Although produce is often stor to avoid it being sold at a loss, it sometim ends up being sold at an even greater lo Cold stores can be expensive, not only b cause their seasonal use means that avera capacity utilization is often low. Therefo efficient existing stores through effective l gistic planning can often reduce the need f new store construction. In Maharasht there are about 35-40 pre-cooling and co storage units which are mainly used f grape fruits for which season lasts only f a few months.

Processing

When prices are low due to overprodu tion, a common response is to suggest th a processing plant may be establishe However, the profitable processing indu tries cannot be based on the occasional su ply of raw material when the fresh mark is glutted. Horticultural processing requir expensive investment on machinery. Id time at factory working hours must be mir mized and this cannot be achieved if pr duce supply is seasonal. To have a succes ful factory, there should be regular ar guaranteed supply of raw materials at price which will enable it to compete in th market. Farmers who demand processin facilities when prices are low will be the fir to sell to the fresh market if prices rise, eve if they have a contract with the factory ar therefore multinational processing unit s up in Punjab for tomato paste and pota products had to be wound up. Similar is th situation for tomato processing plant set u in Sangli district on a co-operative basi Therefore, no factory should be establishe unless the demand for the processed pro uct is clearly identified and that product ca be sold profitably. Market assessment usually and unfortunately the least tho oughly elaborated element of a feasibili study. Attention could be paid to the deve opment of village-based processing activ ties to develop rural processing of fruits an vegetables in the form of jams, *chutney* fruit *murabba*, squash, *puree* etc. Howeve such processing is designed solely to pr serve crops which would otherwise be di carded so that they can be consumed aft the fresh season is over.

Containers produced from locally available materials will normally be more appropriate than those which depend on imported supplies.

Packaging

Packaging has an important role in pr serving and protecting the perishable good In some countries, cabbages are transporte in bulk from one corner to the other corn of the country loosing only outer leav which are stripped off before marketin

s, cabbage provides its own inexpensive kaging material. This is also followed nse of some leafy vegetables.

is often assumed that the quality of kaging is the cause of post-harvest prob-s, but this may not be the case. More ortant may be as to how the packaging erial is handled in the marketing chain. sting containers are either overfilled or rly stored or misused. Truckers and ket authorities often charge on per piece s rather than on weight basis or space upied. Losses also occur due to mishan-g of packaging containers and therefore proved management at all stages of the rketing chain can be promoted through ious training activities. Containers pro-ed from locally available materials will mally be more appropriate than those ich depend on imported supplies. Card-rd carton may be required by an export ustry or in urban areas but requires con-erable investment on manufacturing fa-ies. Plastic containers are generally con-ered ideal for fruit and vegetable market-but they are only likely to be economi-y feasible if the market system can be or-ised to return them for multiple reuse. ey should be at least used twenty times be economically viable but may be diffi-t in reality. It is often a good idea to work hin these inputs, as they can provide the us for training in packaging and han-ng. Frequently, people with the skills to ign technology do not have the skills or rsonality necessary to enable them to rk closely with farmers or the trading mmunity. This factor needs to be recog-ed at project design stage, if post-harvest jects are to be successful.

mand Conditions

Improvements in post-harvest manage-nt may be justified when the prices are h but not when the market is glutted. us, it is feasible that different types of st-harvest handling will be applied for a rticular type of fruit depending upon the son. Where a product has high status siderably, more care will be justified than en it is seen in day-to-day product. metimes, demand conditions have to be ated based on the development of newer cessed product facing more value addi-n and particular dietary characters of the it.

cure of Supply of Inputs

The need to ensure that the supplies of the backward and forward linkage in-ts such as seeds, fertilizers, chemicals, ckaging materials are uninterrupted and gular through government appointed ents, traders or offices. For example, harashtra Grape Growers Federation anges the chemicals like GA, dipping oil d packaging material for their members ides regular analysis of plant and soil for nutrient status. Arrangement of all post-harvest tools, equipments and machinery required for handling, transporting, storing and marketing of horticultural produce to be arranged by such organisation for efficient functioning.

The need to ensure that the supplies of all the backward and forward linkage inputs such as seeds, fertilizers, chemicals, packaging materials are uninterrupted and regular through government appointed agents, traders or offices.

Government Involvement in the Post-harvest System

Governments do have many opportunities to undertake positive steps to improve post-harvest and marketing systems. These include improving rural and urban marketing infrastructures through respective APMC's in the regions, maintaining roads, strengthening and post-harvest skills of the extension services, consignment training and wherever appropriate providing basic market information. Frequently, the cause of post-harvest practices has been traced back to overproduction or to the quality delivered at the initial point of purchase. As it is often observed about computers, if you put rubbish in you get rubbish out. The same applies to food marketing and no amount of expensive post-harvest handling treatment will rescue produce which is basically unsound at the start. Arrangement of transport at reasonable prices during season and simple and easier legislations in movement of perishable goods will also help a long way in solving problems.

Improved Marketing System

Better Market Information : If farmers have access to reliable information about market demands and price trends, they could reduce losses due to excess production demand. If possible, they can plan their production and harvest schedule before prices are expected to drop and after prices start to rise again. Daily or weekly market information can help the farmer to decide when to harvest his produce or how to dispose it off. This information is required for both the farmers and traders for movement of goods from surplus areas to the deficient ones. Local AIR, TV stations and market bulletins could play an important role in this direction.

Arrangement of transport at reasonable prices during season and simple and easier legislations in movement of perishable goods will also help a long way in solving problems.

Market Extension : Subsistence farmers, selling only small surpluses to the market, have linked their requirements in terms of understanding as to how that market works. However, as farmers increasingly concentrate on the production of fruits to supply to urban markets as they need to be much more aware of market forces and of post-harvest practices. Unfortunately, extension services, whilst usually of well trained to provide advise on production aspects, normally lack knowledge of marketing of post-harvest aspects. Ideally, extension workers should have some ability either to advise farmers on marketing aspects or where to get the necessary information he should also be able to facilitate contact between farmers and trades. In Maharashtra, a group of Sangli district based carnation and cut flowers farmers market transport their produce to Mumbai by coming together to get better price for their produce.

Better Markets : Congested/unhygienic markets which offer poor protection from sun and rain can have considerable impact on post-harvest losses 'particularly' for the more perishable produce. Additionally, congestion slows down the speed at which transactions take place and so puts up marketing costs. In a larger proportion of developing countries, markets are not mere functional institutes, but play an important role in the economy of the country and most of the agencies whether central government, municipal authorities or village council look at them as revenue earners. In South America, one encouraging trend is the construction of privately owned wholesale/retail markets in urban areas.

Improved Road and Transport : Feeder roads in rural and remote areas are extremely poor and frequently impassable in rainy seasons. Ungraded, potholed roads lead to produce damage in fruits and cause vehicle breakdowns which when perishable crops are being transported can lead to the loss of an entire consignment. Where roads are passable, they are often in such a bad condition that traders or hauliers working for parastatals are reluctant to use them or impose high charges which can make commercial product uneconomical.

Fruit growing places in remote areas or rural areas suffer from lack of vehicle or shortage of spare parts and there is a need to make transport vehicle available in such areas during the peak of harvest of perishable produce.

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Applications of Biotechnological Approaches for Quality Assurance in Dairy Industry

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Introduction

One of the obligations of dairy industry is to provide clean, nutritious, wholesome and safe processed 'dairy foods' to the consumers. Ensuring an acceptable level of food quality and safety is absolutely necessary to provide adequate protection for consumers and to facilitate trade. These objectives can be achieved by implementing effective quality assurance measures rigorously along the entire food-chain wherever it is appropriate and possible. Everyone involved with the production and processing of milk from the farmer to the manufacturer and eventually to the consumer shares the responsibilities to keep food protected from hazards that can increase human health risks. In view of highly perishable nature of dairy foods which are extremely vulnerable to microbial/chemical contaminants, dairy industry must have a strong network of efficient quality assurance programme to monitor the quality and safety of these foods before reaching the consumers. This can be largely possible with the application of recent developments in biotechnological tools in quality assurance programmes. The sooner the dairy industry adopts and implements these biotechnological interventions, the better for it to make its presence felt both in the national and international markets.

Role of Biotechnology

Biotechnology has already benefitted the food industry in a big way. It has given us high quality foods that are tasty, nutritious, wholesome, convenient and safe. It offers huge potential for increasing the range and quality of food available to us, particularly more nutritious, palatable and stable food. It also seems likely that it will continue to bring advantages to the processing and safety monitoring of food supply due to emergence of new technologies at a faster pace.

Traditional biotechnology has played an important role in the development of our food supplies for thousands of years and such conventional techniques are widely accepted and generally do not cause public concern. Modern biotechnology in contrast to traditional biotechnology also uses the techniques of genetic modification. This allows characteristics to be transferred between organisms to give new combination of genes and improved varieties of plants, animals and microorganisms for use in agriculture and industry. It is the modern biotechnology which is becoming increasingly important part of the overall efforts to improve methods of food production and to increase the variety, quality and safety of foods we eat.

Biotechnology can be defined as a process by which any product can be produced on large scale with the help of a biotechnological system which could be either the direct use of a microorganism or the enzymes produced therefrom after their manipulation at molecular level. Such microorganisms can virtually turn into factories for the manufacture of desired products. It is an interdisciplinary approach involving the intervention of almost all branches of science particularly microbiology, genetics, biochemistry, biochemical engineering, fermentation technology etc. Some of the most powerful tools of biotechnology which have already made great strides in dairy industry include rDNA technology, genetic engineering, gene cloning, hybridoma technology, PCR technology, bioprocess engineering etc. Many of these techniques can be explored in quality assurance programmes undertaken by the dairy industry to produce dairy products of assured quality and safety.

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Potential Applications in Quality Assurance

Quality assurance programme in dairy industry can be effectively implemented adopting emerging biotechnological innovations from time to time, with overall emphasis on improving the quality of dairy products processed, therein, intended for either local consumption or for exports. Some recent advances and developments in this highly specialised areas in this regard will now be discussed in this article.

Monitoring Safety of Dairy Products

Food safety in dairy industry is a very broad topic. In this context, pesticides, detergents and sanitizers, chemical additives and spoilages in the food chain are all of co siderable concern, but food scientists, foo processers and consumers focus their effor mostly on microbiological quality. Microo ganisms pose a serious challenge to the dai industry and hence most of the dairy foo processes are designed with the microbi quality in mind. Many of them produce to ins and cause serious infections. For all the reasons, the microbiological quality of dai foods we eat is scrutinized closel Biotechnology has already resulted in th development of rapid tools to monitor th safety of our food supply.

Microbial Contaminants

It is important to monitor the dairy foo for spoilage and contamination by microo ganisms that can cause serious illness (suc as *salmonellosis, listeriosis, botulinum* etc.) atleast make foods taste off. The use of mo ern biotechnology has proved to be e tremely important in the development rapid, sensitive and accurate methods for th detection and analysis of bacterial contam nants and pathogens or their toxins in o foods. Traditionally, the detection of co tamination of food with undesirable micr organisms is both labour intensive and tim consuming. Biotechnology has led to th development of tests that can be complete in one fifth of the time required by conve tional methods.

Rapid Detection of Emerging High Risk Food Pathogens in Dairy Foods

Development of new innovative metho for rapid detection of emerging high ri food pathogens such as *E. coli*, 0157:H7, *mono-cytogenes, Salmonella* and *yersin enterocolitica* in dairy foods is extremely i portant in this context of food safety. monitor Critical Control Points (CCP) with Hazard Analysis Critical Control Poin (HACCP) system at the level of food produ tion and processing, reliable and sensiti methods are required that will give resu in minutes or hours rather than days. R cent advances in biotechnology have consi erably simplified microbiological procedur for detection of these food pathogens a have reduced the assay time. These assa losely referred to as fast methods encompa a large diverse group of systems that inclu simple miniaturized biochemical assa immuno-assays, nucleic probes and PC based tests.

munological Assay

he immuno-assays, currently being used he detection of food pathogens, are mar-ed in a variety of formats such as rescent antibody technique (Immuno-rescent assay), Immunomagnetic assay, SA, RIA and agglutinin assays. Immuno rescent technique was approved for the sumptive identification of *Salmonella* types but never enjoyed widespread use. sons for its non-acceptance include lack specificity of polyclonal antibodies used he procedure, the tedious nature and sub-ivity of the test and the need for skilled robiologists to perform the test.

ELISA remains the most widely used format for immuno assays. This format has been extensively used to develop methods to detect pathogenic bacteria and bacterial toxins in foods.

The immunomagnetic separation tech-ue has been successfully used as a rapid min.) alternative to 24 hr culture enrich-nt step for the determination of *salmo-la* and *listeria* in foods. Immuno mag-ic-based assays are now commercially ilable from VICAM, USA under the trade mes 'Listerest Lift' for the detection of *teria* and *L. monocytogenes* from foods hout prior enrichment. The main advan-e of this test is that quantitative enumera-n of *Listeria* in the food samples can be de. However, this test also suffers from lengthy incubation steps, specificity blem and cumbersome handling which uire adequate expertise. Similarly, 1-2 test BioControl, USA is another promising OAC approved method used for rapid de-tion of *Salmonella* in all types of foods. hough, this test considerably reduces the tection period to almost 24 hrs, it fails to tect non-motile strains of *salmonella.*

ELISA remains the most widely used for-t for immuno assays. This format has en extensively used to develop methods detect pathogenic bacteria and bacterial xins in foods (Noterman and Wernars, 91). This format has been successfully ed for detection of *Salmonella, Listeria* and ner pathogens in foods. The limit of de-tion for most ELISAs generally range from to 10^6 cfu/ml. Consequently, extensive ltural enrichment of the foods is required or to ELISA. The TECRA immunocapture ISA uses a sensitized dipstick to capture thin 20 min. from 24 hr food pre enrich-nt broth (Flint and Hartley, 1993). A modi-d version of this test - the TECRA Unique *lmonella* is also ready for marketing and s been claimed to give results in less than hrs. A recent arrival on the market is the pstick immunoassay of *Salmonella* which s a sensitivity of 10^6 cfgu/ml. and the as-y time is 20 min. following 2 days of cul-ral enrichment. Unfortunately, these ELISA-based tests like other immunoassays also suffer from cross reactivity, requirement of pre-enrichment and difficulties in obtaining species specific diagnosis.

DNA Probe-based Assays

Nucleic acid based assays are supposed to be exquisitively sensitive and reliable as the genome of the organism is responsible for the expression of biochemical or serological characteristics of the target organism. Rapid test kits which rely on the interaction of nucleic acid probes with the conserved or marker sequence of target nucleic acids have been developed. Virulence associated genes are commonly targeted for the detection of pathogens in foods. Two types of nucleic acid probe-based tests (colorimetric and chemiluminescent) are available for *Salmonella* and *Listeria.* The gene track system uses a dipstick coated with polythymidine residues and two nucleic acid probes. Another important innovation in DNA probe technology is the reversible target capture assay (RTC) which serves the dual functions of separating unhybridized probe from the probe target complex and increasing the sensitivity of the overall hybridization reaction several-fold by greatly reducing the background noise. The RTC has been applied to the detection of *listeria* species and reportedly can detect six *listeria* cells in a background of 1.25×10^7 other bacteria after 3 target capture cycles.

Nucleic acid based assays are supposed to be exquisitively sensitive and reliable as the genome of the organism is responsible for the expression of biochemical or serological characteristics of the target organism.

PCR-based Detection of Food Pathogens

Polymerase Chain Reaction (PCR) has recently emerged as the most powerful molecular technique in the area of diagnostics. It is now being increasingly used in food and dairy industries for monitoring of foods for potential food pathogens, so that the safety of these foods could be ensured from public health point of view. Application of such methods in Food Quality Assurance and Public Health Labs can go a long way in protecting the health of the public. The crucial feature of sample preparation in the direct analysis of food without cultural enrichment is the isolation of target DNA with high reproducibility and efficiency. Construction of the actual PCR assay requires nucleotide sequence information and knowledge about the chosen target gene to guarantee maximum specificity and sensitivity. By using different formats of PCR, it is now possible to simultaneously detect more than one food pathogen in the food. PCR-based detection of food pathogens has completely revolutionized the area of diagnostics as the results are available in less than 24 hrs to enable the food processing units to take appropriate follow up action if a pathogen is detected in a food to avoid any risk to the consumers.

An increasing number of reports do indicate that application of PCR for the detection of pathogens in foods is a promising new diagnostic tool to monitor food safety. Organisms detected by PCR that are responsible for food borne disease outbreaks, PCR specific primers, probes of amplified target DNA utilized, amplification protocols and foods and sensitivity levels have been extensively studied by different workers from developed countries. In most of these studies, PCR had been performed on only pure cultures of pathogens that were isolated from food samples. However, fewer reports describe PCR system for direct detection of microbial pathogens present in food samples. The majority involve an enrichment culture from which the DNA is extracted and on which the PCR assay performed. Also, only a few studies used oligonucleotide probes to detect PCR amplified DNA specific microbial pathogens isolated from foods on gels.

Although, new PCR-based methods for the detection of pathogenic organisms in foods are being reported continuously from the developed countries, similar information from third world countries like India draws almost a blank. There is hardly any report pertaining to PCR-based detection of food pathogens from India. As far as we understand, our Molecular Biology group at NDRI is the first to initiate work on PCR-based detection of food pathogens of serious health concern. Recently, we were able to detect coliforms, *E. coli* and LT enterotoxigenic strains of *E. coli* from artificially contaminated milk and water samples by amplifying the specific targeted genes sequences with the help of PCR- reaction using lacZ, uid A and LT primers. We were also successful in detecting LT toxin producing strains *E. coli* from two naturally contaminated water samples (Mona, 1996). This is perhaps the only report of this kind available from India. A relatively simple protocol designated as 'NDRI method' was developed for extraction of PCR inhibitor free template DNA from milk.

Polymerase Chain Reaction (PCR) has recently emerged as the most powerful molecular technique in the area of diagnostics.

A PCR assay targeted against 16s rRNA sequences was also developed for rapid detection of all different types and strains of *E. coli* (Sanjeev, 1999). The sensitivity of the assay was 10 cells or 1 ng of the template DNA. By using this PCR assay, 50% of the

raw milk samples revealed the PCR product indicating the presence of *E. coli*. A highly sensitive and specific multiplex PCR assay has been developed which can unequivocally detect the presence of *E. coli* 0157:H7 directly from naturally contaminated raw milk samples in less than 8 hrs (Suresh, 1999). The assay was found to be highly specific as it produced PCR products of 152 bp (*E. coli* specific) and 625 bp (*E. coli* 0157:H7). The assay was found to be highly specific. When this multiplex PCR assay was directly applied to 24 raw milk and 25 kulfi samples collected from different sources, *E. coli* 0157:H7 could be detected in one of the milk samples without 4 hr enrichment in CT-SMAC broth and three samples after 4 hr enrichment. However, all the pasteurized milk samples gave a negative signal for this organism. This situation with kulfi appears to be quite alarming since *E. coli* 0157:H7 was detected in as many as ten samples. This appears to be the first report of its kind in India wherein *E. coli* 0157:H7 has been detected directly from raw milk samples, thereby, indicating that the possibility of this high risk pathogen gaining access into milk and milk products produced in our country does exist. In view of high incidence of potential pathogens in foods in general and milk and milk products in particular produced in our country, the PCR-based detection of such food pathogens has become extremely relevant in Indian Dairy Industry which now handles more surplus milk for processing into different products for local consumption as well as for export. The consumer awareness has also necessitated the application of such rapid methods as PCR for detection of food pathogens to ensure the microbiological safety of foods for human consumption. The Quality Control and Quality Assurance labs connected with Indian Dairy Industry still use traditional lengthy culturing methods for the detection of food pathogens like coliforms, *E. coli, salmonella* spp., Sh. *dysenteriae, Staph. aureus, Listeria monocytogenes, V. parahaemolyticus* and *Yersinia enterocolitica* etc. which do not serve any useful purpose due to unavoidable delayed results. In this context, development of PCR-based methods in conjunction with immunological assays would prove to be extremely valuable for proper monitoring of the safety of milk and milk products produced in this country in the light of HACCP concept. Attempts are now being made on our laboratory to develop PCR-based kits for detection of other food pathogens like *L. monocytogenes, Salmonella* and *yersinia enterocolitica* in dairy foods.

Other Formats of PCR

A recent development in PCR is the use of nested primers and magnetic separation of the PCR generated fragments (MS-PCR) along with different signals transducing systems. This technique now designated as Detection of Immobilized Amplified Nucleic Acid (DIANA) can detect PCR products without the need for separation on agarose gel. By using this technique, Kapperud *et al.* (1993) were able to detect 10-30 cfu of *Y. enterocolitica/g* of food in 10^6 fold excess of indigenous flora.

Although, these new PCR-based techniques used in conjunction with IMS and DIANA have considerably improved the results of rapid detection of food pathogens in non-dairy foods, their full potentials are yet to be realized in case of milk and milk products. The only constraint with these methods is the requirement for polyclonal/monoclonal antibodies specific for a particular pathogen and immunomagnetic beads. However, these methods can be easily adopted by Dairy Industry in Quality Assurance and Food Labs for routine monitoring of dairy foods. Later, Stone *et al* (1995) developed a rapid and sensitive assay that uti lized a short cultivation period followed by PCR. For detection of amplified product, an ELISA based oligonucleo-tide ligation assay (OLA) was used. Recently, Tseng *et al* (1997 developed a semi-quantitative homogenou fluorescence assay that combined PCR am plification with direct fluorescence detectio (HG-PCR) and used for verifying suspec colonies of *Salmonella* with 2.5 hrs. HF-PCI was found to be highly sensitive, simple accurate and reproducible.

Since, conventional PCR fails to discrimi nate between viable and non-viable cells o the targeted pathogen, currently Rt-PCI based techniques are now being explored by targeting mRNA since the later is a good index of viability.

Table 1. Biotech Kits for Food Testing

(Ahmed *et al. 1998)*

Firm	Product	Technology
Diagnostix, Inc. (Burlington, NC)	Bio orbit surface monitoring system	ATP bioluminescence
Difco Labs. (Detroit, MI)	*E.coli* rapid detection kit	Immunoassay
Dynal International (Lake Success, NY)	Dynabeads™ anti *E.coli* 0157, and Dynabeads™ anti *Salmonella*	Immunomagnetic separation technology Immunomagnetic separation technology
Biocontrol Systems (USA)	Colidisc™ test	Discs impregnated with fluorescent dye (4-methyl unbelliferryl glucuronid)
Biocontrol Systems (USA)	1-2 test	Antigen-antibody reaction with prior enrichment
VICAM (USA)	'Listertest lift' for *Listeria monocytogenes*	Listeria specific monoclonal antibodies
Gene Trak™ Systems (Hopkinton, MA)	Colorimetric Gene Trak™ assay for *E. coli* and *Salmonella*	Nucleic acid hybridization
Idetek Inc. (Sunnyvale, CA)	BIND *Salmonella* rapid assay kit	Bacterial ice nucleation technology (BIND)
Igen Inc. (Gaithersburg, MD)	Origen™ Analyzer	Combined IM and ECL technology
Neogen/Ampcr Inc. (Lansing, MI)	*Salmonella* and *E.coli* detection kits	Immuno assay
Organon Teknica (Durham, NC)	EHEC-Tek™ for *E.coli*	ELISA
Qualicon™ (Wilmington, DE)	BAX™- pathogen detection system	DNA amplification technology (PCR)
Tecra Diagnostics (Sydney)	Kits for *Salmonella* and *E. coli*	ELISA
Vicam (Watertown, MA)	24 hr. test for *Salmonella*	Immuno assay technology
IDEXX Labs Inc. (Westbrook, ME)	Luminometric assays	ATP bioluminescence
Perkin-Elmer Holding (Germany)	TaqMan *Salmonella*	DNA determination and PCR technology

otech-based Assay s for Monitoring fety of Dairy Foods

Recent advancements in biotechnolo-gical ls such as ELISA, DNA probes, Luxo-on systems, electro-chemiluminiscence R etc., have paved the way for develop-nt of several biotech-based kits for detec-n of food-pathogens in dairy foods as in-ated in Table 1. Most of these kits are less our intensive and give results much faster n the conventional and traditional meth-s. Many of these tests are within the reach he Indian dairy industry and can help in osting the confidence of consumers from hin the country and abroad in Indian iry Foods. These tests are highly specific, id, reliable and reproducible and require ttle technical expertise as they are avail-e in the form of ready-to-use kits.

osensors and ality Assurance

Biosensors represent analytical new gen-tion of powerful tools incorporating bio-ically derived material or biomimic with hysio-chemical transducer or transducing cro-system. Biosensors are currently be-explored for a wide range of applications food industry. The techniques based on sensors are being developed for rapid e direct or indirect detection of foodborne croorganisms, toxins, or undesirable tabolites or other compounds. These sys-ns have a potential application in real-time idation of critical control points. Sensi-e, specific and rapid processes have been veloped that require minimal culture en-hment and utilize immuno-based sensors, such as immuno magnetic electro emiluminescence to detect pathogenic croorganisms in food systems. Immuno-sed biosensors to detect low levels of *E. i* 0157 and *Salmonella* within 2-8 hr. are rrently being field-tested in meat and poul-plants and would soon find application dairy industry as well. Flow cytometry ovides a precise means for the rapid de-tion and characterisation of individual ls from mixed population. Cells are indi-dually illuminated by an intense light urce and data are collected and analysed rough computer. When combined with an propriate fluorescent reporter molecule g. labelled nucleic acid probes or antibod-)., low numbers of specific pathogens can detected against a high background of mpeting microflora. New technologies ch as acoustic have biosensors and radio quency identification (RFID) sensor tags omise to greatly improve food safety. Re-arch to develop a single computer chip that ll automatically assess food safety at any int from source to consumption is ongo-g.

Biosensors use antibodies or enzymes to eract selectively with targeted toxins or thogens and then one of several possible transduction mechanisms to detect that interaction. In this inherently multi-disciplinary field, rapid and sensitive biosensors for food pathogens such as *salmonella typhimurium* and *escherichia coli* are being developed. Food-borne illnesses afflict millions of people and incur cost of hundreds of millions of dollars each year, but standard laboratory testing methods are expensive and require two or three days to process. Food processing plants and wholesale and retail sales outlets have a great need for rapid, on-site sensors that are sensitive enough to detect trace amounts of food-borne, pathogens for application in dairy industry and other food processing units. Several kinds of biosensors are being studied by different companies, including those based on fluoroescence, surface-enhanced infrared absorption (SEIRA) spectroscopy, and quartz crystal microbalance. One such system which shows lot of promise is an acoustically enhanced fluorescence sensor. It starts with standard "sandwich" immuno-assay in which a primary antibody captures a pathogen (e.g. *salmonella typhimurium)*, which in turn, captures one or more fluoroescently labelled antibodies. For efficient pathogen capture, the primary antibodies must be distributed throughout the sample volume. However, for efficient detection of the 'sandwich' complexes, the concentrations must create the correct optical excitation-to-detection volume ratio.

Biosensors are currently being explored for a wide range of applications in food industry.

A biosensor called origen™ analyzer has been developed by IGEN Corporation of Gaithersburg in Maryland (USA) which combines two technologies namely immunomagnetic (IM) separation and electro-chemiluminescence (ECL). Studies on this sensor indicate that IM-ECL assays in food are not only sensitive but can performed within an hour of total reaction and assay time. Diagnostic Inc. (Burlington, North Carolina, USA) has recently introduced their 'Bio-orbit' hygiene monitoring system which provides on-the-spotest results, using ATP bioluminescence technology. With ATP test, results are available in seconds. Nucleic acid hybridization has been employed by Gene-Trak™ (Hopkinton, Massachusettes, USA) for the detection of *E. coli* in food commodities. These tests use pathogen specific DNA probes and a colorimetric detection system called the 'Gene-Trak photometer' or 'DATA-TRAK recording photometer'. These tests, however, require initial enrichment in broth culture. Gene-Trak has also developed the *Salmonella* Direct Label Probe (DLP), a DNA hybridization test that uses *Salmonella*-specific DNA probes directly labelled with an enzyme horse radish peroxidase along with a colorimetric detection system.

Apart from food pathogen detection, biosensors are being explored for detection of other toxicants of microbial or non-microbial origin and hence could play a significant role in ensuring the safety of diary foods.

Detection of Microbial Toxins and Other Pollutants in Foods

Food safety is a major concern of the food industry, regulatory bodies and the consumers. Assurance of both the safety and quality of food is perhaps the most important aspect of food production. Many times, the safety and quality of foods including the dairy products are violated due to addition of contaminants other than micro-organisms in such foods through man made or inadvertent interventions during production and health of the consumers is at risk. Foods may contain toxic compounds such as allergens that can cause adverse reactions in susceptible individuals. In addition, foods can also contain other contaminants such as toxic metabolites of microbial origin namely mycotoxins (afatoxins), residues of antbiotics/drugs and pesticides etc which may reach the raw material i.e., milk used for processing. Hence, timely detection of the presence of these contaminants in dairy and other foods is of paramount importane to ensure their safety to health of the consumers. In this context, biotechnological innovations could come to the rescue of the dairy industry by providing sensitive assays for accurate monitoring of foods for all these possible toxic components.

Pesticides and Antibiotic Residues

Many commercially available diagnostic kits have been developed for the detection of residues of pesticides (DDT, methoxychlor etc) and veterinary drugs (antibiotics) in milk and milk products. Most of these biotech kits are extremely sensitive and are based on microbiological and immunological assays either ELISA, RIA, Monochnal antibodies etc. The utility of antibodies for diagnostic and therapeutic applications depends primarily on their affinity, kinetic and stability properties. To explore this feature, Irish scientists employed enzyme linked immunosorbent assays (ELISA) and state-of-the-art bio-sensing technology to select these molecules, define their characteristic and develop novel diagnostic assays. The current areas of interest for application of these assays include food and environmental contaminants and development of novel assays for illegal drugs. This research has wide applications, at present, considering the media coverage given to outbreaks of *E. coli* 0157 and *Listeria*, overuse of pesticides and antibiotic residues.

Another technique, "Real time" biomolecular interaction analysis (BIA) using the BIACORETM system developed formats and to develop novel analytical strategies.

Immuno-assay development using BIA technology obeys many of the principles applicable to ELISA, but does not require labelling of the antibody or the antigen. Moreover, the biointerface can be regenerated using pH shock, thus allowing the ligand-coated sensing element to be used repeatedly. Their biosensor development program, funded by Enterprise Ireland, has successfully produced new "real-time" biosensing devices for direct monitoring of interactions involving low molecular weight affinity recognition molecules.

Antibiotic Residues

Due to indiscriminate use of antibiotics and drugs such as beta lactam, tetracycline, streptomycin, novobiocin, erythromycin, suphona-mdies, chloramphenicol etc. to control diseases such as mastitis etc. in dairy cattle and buffaloes, residual amounts of these inhibitors can reach milk supply. The presence of antibiotic residues in milk even at low levels could be of serious concern because of their role in allergic reactions, starter failures and emergence of antibiotic resisitant bacteria. This unforeseen situation warrants the need for detection of residual antibiotics in milk to minimize the undesirable effects associated with such drugs. Although, a number of tests have been developed for qualitative and quantitative detection of antibiotic residues in milk, they are not sensitive enough to detect low levels of these antibiotics. However, currently some biotechnology-based assays have been developed which are extremely sensitive and accurate for making quantitative analyses of antibiotic residues in milk as given in Table 2.

Fungal Toxins

Some fungi produce chemicals called 'Mycotoxins' that are extremely poisonous and include cancer causing aflatoxins which can gain access to milk and milk products through mold contaminated animal feeds. Efforts to limit mycotoxins in human food and animal feeds are based on concerns over the adverse effects of direct exposure to mycotoxin-contaminated food and feed on human or animal health, and potential mycotoxin residues in foods of animal origin. Food producers and processors are increasingly challenged to understand mechanisms of mycotoxin formation and to develop control and prevention measures. Modern biotechnology has led to the development of test kits for the rapid detection of aflatoxins in such foods and thus can help the dairy industry to ensure that no affected products are marketed. In this context, Irish state laboratory has developed an assay system based on an ELISA kit for screening alfatoxin M1 and B1 which can be substantiated by HPLC (official method) with post column derivatization after sample clean up. However, there are problems with ELISA tests arising from a relatively large number of false positives which must be verified by expensive and laborious official methods. This assay is going to be developed in to the form of a biosensor for direct application in foods.

Starter Culture Identification

Lactic Acid Bacteria (LAB) such as Lactococci, Leuconostocs, Lactobacilli, Pediococci, Propionibacteria and Bifido-bacteria are extensively used as starter cultures in dairy industry for the manufacture of a variety of fermented dairy products. Their role in fermented foods is now well documented and is chiefly attributed to acid and flavour production along with therapeutic and other health promoting attributes. However, the quality of fermented food is greatly influenced by the quality of the starter culture used for fermenting milk. Since the diversity of starters used in dairy industry is low, new and natural native strains of these organisms with unique properties have to be isolated from indigenous fermented foods and identified at molecular level. This would not only help the preservation of bio-diversity of these food-grade starters but also can contribute in the diversification of product development. One of the prerequisites to explore the commercial value of lactic starters to the best of their ability is their correct identification. The conventional identification protocols used for describing these organisms are based on their phenotypic properties and hence are not only unreliable but also laborious and time consuming. With the advent of recombinant DNA technology and other biotechnological tools, the identification and typing of starters has not become more simpler and authentic. The current biotechnological techniques used for characterization of different starter cultures for dairy application include 16 S r-RNA sequencing, PCR, RAPD, RFLP/DNA finger printing, plasmid profiling, gene mapping Nucleic acid hybridizations etc. (Corroler *et al* 1999, Chen *et al*, 2000, and Walter *et al* 2000).

Some of these techniques can be used in food Quality Assurance Labs after getting some expertive alongwith other test for handling and maintenance of prover starters for cheese making and preparation of *dhai*, yoghurt, *srikhand* etc. Dairy industry can benefit immensely by adopting some of these specialized techniques.

Genetically Modified Organisms (GMO) and Foods

The application of genetically modified organisms in foods has been at the centre of controversy for quite some time, both at national and international level. Despite a fair amount of debate and discussions, no consensus appears to be on the sight. This is because the issues are complex and relate to different aspects of social and economic life. Dairy industry is also confronted with this sensitive issue concerning the use of genetically modified starter cultures for manufacture of fermented dairy foods. Because of long term safety concerns of geneticall modified foods characterized as transgenic foods, it has now become important to identify the genetically engineered organisms in the GM foods and the environment. Several countriesand communities are currently funding research projects with the objective of developing or optimising methods for the detection of genetically modified organisms. Most of the research efforts on the identification of food stuffs consisting of or containing GMOs. Newer identification methods are now being developed for rapid detection of GMOs in foods taking into specific consideration the problems associated with the food-matrix and the respective targeted organisms. These are based on multiple PCR, PCR-ELISA, DNA Biosensors, direct hybridization, TSR, NASBA, AFLP and protein diagnostic approcaches. Quality Assurance Laboratories associated with dairy industry can play a significant role by monitoring dairy foods for genetically modified organisms or their recombinant products with the help of such powerful biotechnological techniques. Proper identification of GMOs in the dairy foods would enlighten the consumers of the true picture of the food they are going to eat in the backdrop of the current debate on GMO foods.

Table 2. Quantitative Analyses of Antibiotic Residues in Milk

Name/Test	Basis	Antibiotics	Sensitivity
Delvo test	Microbiological	β-lactam	0.05 IU/ml
Charm test I, II, III	Microbiological (Radioactive assay)	β-lactam (Penicillin G)	0.01 IU/ml
Penzyme test	Enzymatic (DD Carboxy peptidase)	β-lactam	0.05 IU/ml
ELISA	Immunological (MoAb)	β-lactam	0.005 IU/ml

Conclusion

From the foregoing presentation, it can be concluded that application of biotectnological approaches in quality assurance programmes in dairy industry in India and other third world countries can considerably improve the quality of our dairy foods along with ensuring their safety from consumer health point of view. By adopting these approaches pragmatically in a phased manner Indian dairy industry is poised to make dent in the international market.

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Functionality of Starch Hydrolysates

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troduction

Starch is a low priced and an attractive v material for food industry. World starch oduction is between 20 to 25 million nes per year, of which 10-12 million nes are used for food purposes only earsley and Sicard, 1989). Particularly in lia, of the 3,65,000 tonnes of starch pro- ced, about 1,76,000 tonnes are used by the od sectors and from this about 1,57,600 nes mainly as the hydrolytic products las *et al.*, 1997). In the past, the use of rches was self-limited in food applica- ns because they lack process tolerance d cause problems like poor texture, loss viscosity, instability and syneresis in led products.

To meet the changing requirements of the od industry i.e., the production of low orie and in particular low fat products, rch is being modified. For many years, e starch hydrolytic products with high xtrose equivalent (DE) have been used as gar replacer. However, the low DE starch drolytic products have been newly dis- vered for use as fat replacer. Unfortu- tely, the commercially available low DE drolytic products are generally prepared using acids and cannot be intended as fat metic due to their homogeneous molecu- distribution of saccharides (Roller, 1996).

To overcome these problems, new ocessing techniques involving enzymatic drolysis have been developed. Not only es this result in almost tasteless and solu- e low DE hydrolysates with wider appli- tions, but also allows a greater flexibility the final composition of the products. It claimed that low DE hydrolysates are ed in different foods for their multifaceted nctions, viz., bulking agent, viscosity en- ncer, gelling agent, aiding dispensibility, lubility, fat like property and improved sensory properties (Setser and Racette, 1992). In comparison to other fat replacers, the commercial success of low DE hydrolysates is mainly based on low sale price and improved sensorial properties of final product. However, a thorough knowledge regarding the physico-chemical and functional properties of these hydrolysates is essential for specific end use.

Hydrolysis of starch usually involves the use of enzymes, acid- (and less frequently base-) catalyzed reactions, thermolysis alone and thermolysis combined with acid-catalyzed hydrolysis.

Now-a-days, there are, number of starch-based fat replacers, being marketed in most of the developed countries but most of the technologies have been patented. In Indian context, the awareness of this product is quite insipid. It is worthwhile to note that a review on this aspect will be more useful to food technologists while formulating a low fat product.

Enzymatic Modification

The first scientific report on modification of starches was published by Roard (1804) and concerned the dry thermolysis of starch to dextrins. Since that time, starch has sustained significant interest as the source of nutritional and non-nutritional products. Hydrolysis of starch usually involves the use of enzymes, acid- (and less frequently base-) catalyzed reactions, thermolysis alone and thermolysis combined with acid-catalyzed hydrolysis. Enzymatically hydrolyzed products are generally produced by passing a starch slurry containing heat stable α-amylase through a jet cooker. Gelatinization is necessary, because owing to its compact granular structure, starch is resistant to rapid enzyme attack. The gelatinized and partially hydrolyzed starch paste is passed through holding coils to obtain the required viscosity. The enzyme is then inactivated at elevated temperature after which the product is ready for use (Dias, *et al.*, 1977). Hydrolysis of starch using immobilized α- amylase on the surface of steel paddles was also reported (Cruz, 1976). Ramirez and Ghozlan (1993) have reported a continuous process for the manufacture of partially hydrolyzed starch based on cold enzymatic hydrolysis of a comminuted starch rich substrate. Similarly, a method for continuous production of starch hydrolysates based on partial hydrolysis of starch solution using an α-amylase preparation in the presence of Ca^{2+} and sodium carbonate has been reported by Kirilova *et al.*, (1993). The progress of hydrolysis can be observed by measuring the DE value, carbohydrate content, dextrin molecular structure, oligosaccharide composition and viscosity of the solutions (Nebesny and Lodz, 1990).

Reaction Conditions

The degree of hydrolysis was shown to be strongly dependent on the degree of polymerization of native starch (Danilenko *et al.*, 1993), enzyme concentration, hydrolysis time and incubation temperature. Recently, Marchal *et al.*, (1999b) have stated the effect of process conditions on the α-amylolytic hydrolysis of potato amylopectin under industrially relevant conditions. However, the exact composition of α-amylolysate was reported to be dependent on the concentration and source of enzyme (Hall and Manners, 1978). The various factors are summarized as follows:

Substrate: The concentration at which the hydrolysis reaction takes place influences the saccharide composition (Marchal *et al.*, 1999a). Starch hydrolysis products (SHPs) are industrially produced by enzyme reactions from a dissolved solution of starch (up to 40% w/w). Levine and Slade (1986) reported that a major variable for molecular weight distribution among different food starch sources involves the original amylose/amylopectin ratio of a starch and the consequent ratio of linear to branched polymer chains in SHP. This variable can be particularly pronounced among a set of low DE SHPs, which would contain higher DP fractions. These starches also differ in levels of impurities such as lipids, proteins, pentosans and ash content, which may require further downstream processing to eliminate these components.

Enzymes

The most important tool in providing a saccharide with a specific composition is the use of enzyme with different specificities towards hydrolyzing starch. The saccharide profiles obtained after hydrolysis of starch with either solubilized or immobilized enzymes were shown to differ (Hisamatsu *et al.*, 1996). The increased product specificity of the α-amylase caused by immobilization supported the postulation that an increase in enzyme rigidity increases the substrate specificity (Marchal *et al.*, 1999c). The α-amylase hydrolyzed starch by splitting internal α-(1,4) D-glucosidic linkages, thereby causing rapid liquefaction and slower dextrinization and saccharification. Some of these enzymes require either Ca^{2+} or Cl^- ions for activity. Malt α-amylase should not be used with citrate or phosphate buffer which removes calcium while bacterial and animal α-amylase require the addition of chloride ions for activation. The optimum pH of α-amylase varies with the source of enzyme (mammalian α-amylases, pH 6.0-7.0; bacterial α-amylases, pH 5.5-6.5; fungal α-amylases, pH 4.8-5.8 and barley-malt amylase pH 4.7-5.4) The composition of α-amylases was also observed to be dependent upon enzyme concentration (Hall and Manners, 1978). It was reported that during the final stage of α-amylolysis, maltotriose is produced, which is hydrolyzed to maltose and D-glucose, if the enzyme concentration is increased.

Temperature

The first indication that temperature at which α-amylolysis is conducted, influences the saccharide composition was reported by Ramesh and Lonsane (1989). The temperature has been found to have a distinct influence on the oligosaccharide composition during the hydrolysis of starch. A higher temperature led to a loss of heterogeneous molecular weight distribution during the initial phase of hydrolysis due to the decrease in specificity of α-amylase at high temperature. While the product specificity of α-amylases increased with decreasing temperature of hydrolysis (Marchal *et al.*, 1999c). Accessibility of barley starch granules to α-amylase at different stages of gelatinization was studied by Lauro *et al.*, (1993). Increased amount of solubilized carbohydrate was observed when pre-heating at temperatures of 55-60°C and α-amylase treatment at 30°C was done. In these studies, however, there were substantial differences in the degrees of hydrolysis between the different temperatures investigated.

The most important tool in providing a saccharide with a specific composition is the use of enzyme with different specificities towards hydrolyzing starch.

Characteristics of Starch Hydrolysates

Numerous papers have appeared in the recent past describing the product profiles of starch hydrolysates (Manners and Marshall, 1971; Bertoft, 1989; Danilenko *et al.*, 1993). Setser and Racette (1992) have suggested that the small, intact and swollen starch polymer actually duplicate the mouth sensation of fat and/or on association with protein molecules presumably contribute to the fat like mouthfeel. Similarly, Pszczola (1991) claimed that the acid hydrolyzed corn starch contained irregularly shaped particle aggregates of 3 to 5 µm in diameter which were having approximately the same size as the fat crystals that they replace. This system was likened to fat crystals in a continuous oil phase and readily deforms similarly as fat and the molecular weight of these amylodextrins is found to be less than 20 kDa.

Although the elucidation of dextrin structure present in starch hydrolysate is of a reason to study on this line, it is mainly the dextrin content and molecular weight of the hydrolysates that determine the functional properties of the hydrolysates.

The product profiles of starch hydrolysates have been reported to be D-glucose, maltose maltotriose and a series of branched α-limit dextrins (Manners and Marshall, 1971). But actually, the first structural investigation of starch dextrins having functional significance, were made by Brimhall (1944) on a commercial maize dextrin of British gum type by sub-fractionating the dextrin and precipitating it from 70% aqueous methanol and methylation followed by end group assay. Some investigators have used carbon columns and ethanol solutions to separate the malto-oligosaccharides (Johnson and Srisuthep, 1975). They obtained pure fractions of the lower molecular weight sugars with ease, but experienced increasing difficulty as they attempted to separate the higher polymer fractions.

Fujita, *et al.*, (1996) observed pinholes on α-amylase digested granules through scanning electron microscopy. Different reports on the formation of series of malto oligosaccharides using HPLC and paper chromatography are also available (Johnson and Srisuthep, 1975; Ramesh and Lonsane 1989; Ivanova *et al.*, 1991). Moreover, high performance anion exchange chromatography using a pulsed amperometric detector is also suggested to be a useful technique for qualitative and quantitative analyses of monosaccharides, oligosaccharides and homoglucan series (Koizumi *et al.*, 1989).

It was suggested that the α-amylosis involves two independent processes, namely formation of maltohexaose from the external chains and of branched intermediate dextrins by fission of longer internal chains (Bertoft, 1989). Similarly, gel chromatographic study using agarose gel was also reported by Yamada *et al.*, (1976) but all the degradative products were not separated. However, Hizukuri (1996) suggested that a column with single pore size would not give a good separation of starch hydrolysis products while columns with different pore sizes could be employed.

From these reports, it is envisaged that no satisfactory work has been done to characterize the various dextrins in starch hydrolysates, which seem to have fat-like property.

Functional Properties

Although the elucidation of dextrin structure present in starch hydrolysate is a reason to study on this line, it is mainly the dextrin content and molecular weight of the hydrolysates that determine the functional properties of the hydrolysates (Nebesny and Lodz, 1990). As the molecular weight of dextrins and their content decrease during starch hydrolysis, the properties of dextrose are approached where the presence of larger dextrins shows properties more towards starch i.e. the DE hydrolysates with high dextrin content bridging the property gap between starch and traditional corn syrups. Setser and Racette (1992) have reported that low DE SHPs have good water binding properties and can function more effectively as replacers in comparison to high DE SHPs.

Solubility

Starches in native state are insoluble and swell only to a limited extent upon gelatinization. Starch hydrolysates, however, are water-soluble and the solubility increases with increasing DE value (Murray and 1973). As a fat replacer, it should e

perse in water and should not easily rate. Johnson and Srisuthep (1975) re- ted dextrins with DP 8-10 or above wed limited solubility. Setser and Racette 2) also reported that low DE SHP from ato starch at less than 30% concentration swollen in cold water whereas low DE P from corn starch at 40% concentration dissolved in water.

Viscosity

The functional property of SHP, which is most commercial interest, is the reduced cosity. It is desirable for low fat products llow for other solids that are added to system, yet still remain flowable after solids are added (Lelievre, 1992). Gen- lly, the viscosities of starch hydrolysates rease with decrease in size and the con- t of dextrins. Johnson and Srisuthep 75) reported that the viscosities of gosaccharides with DP up to 7 increased early with increasing both concentration d DP, while the viscosity of DP more than ncreased curvilinearly with increase in ncentration.

Gelation

In native state, starch gels are elastic but ily broken beyond pH range 4 to 9.5, but gel strength weakened as the granule ucture disrupted (Collison, 1968). Aggre- ion and gel formation have been shown occur more quickly in case of amylope- hydrolysates and the gel strength in- ased during storage, was considered to characteristic of many low DE hydro- ed starch gels (Dorp and Vom, 1991). rchal *et al.* (1999a) reported that low DE rch hydrolysates formed gels at high con- ntration (>20% w/w). Levine and Slade 86) also reported that hydrolysate with -6 formed thermo-reversible gel at above tical polymer concentration. Similarly, pin *et al.*, (1984) reported that DE-5 to 8 drolysate gels derived from amylopectin re apparently composed of a network of gh molecular weight (above 10 kDa) anched-dextrin molecules.

The key physical characteristics of low hydrolyzed starches are that they pro- ce soft, spreadable gels with melt-in-the- outh properties that give a fat-like outhfeel to food products (Dorp and Vom, 1). The capacity of these gels to compen- e textural and physical properties of milk may be attributed to two mechanisms impact on mouthfeel and colloidal prop- ies of these hydrolysates. According to tser and Racette (1992), hydrated starch rticles influence on how the frozen mass perceived as it liquefies in the mouth i.e., elling creates large granules that lubricate crystals and amplify the perception of eaminess. Similarly, by acting as drophilic colloids, they increase the vis- ity of the continuous phase, there by using improvement in foam formation d stability.

iv) Water Holding Capacity

Direct removal of fat from food often causes textural defects due to the alteration of physico-chemical properties. Thus, structuring the aqueous phase is a major challenge for the food scientists. The low DE hydrolysate gels are said to immobilize water uniquely and associate with a large number of water molecules primarily through hydrogen bonding (Nielsen, 1984). The water binding property of dextrins was speculated to control viscosity and slow release of water in mouth and thus stimulating the moist mouthfeel like a high fat product. These polymers also act as hydrophilic colloids, thereby increasing the viscosity of the continuous phase. By doing so, the foam formation and stability are improved and the growth of large ice crystals during freezing is restricted. In addition, the heat shock during storage and phase separation during meltdown is inhibited in product – like ice cream (Setser and Racette, 1992).

In addition to fat substitution, starch hydrolysates have been reported to increase the spreadability of milk solid based spreads and also used for micro-encapsulation of milk fat.

v) Stability

The low DE hydrolysates of waxy varieties are more stable in solution due to a small amount of linear saccharides produced from the virtually absent amylose in starch. Low DE SHPs are wellknown drying aids for processes viz., freeze drying, spray drying and drum drying through their elevating effect on sub-zero glass transition temperature and reducing the unfrozen water fraction (Levine and Slade, 1986). SHPs are normally spray-dried and found to have good stability during storage. Bennett (1986) reported the shelf-life of starch hydrolysates to be greater than or equal to 5 months. The degraded starches could provide low temperature stability for long term storage conditions, thereby overcoming the disadvantages of native starches (La Barge, 1988).

vi) Fat-like Property

Until today, the concept of using carbohydrates as fat replacer would have been almost unthinkable. One of the fastest growing markets in recent trend is the wide range of foods and drinks with "low fat" or "low calorie" attributes. The use of starch hydrolysates as fat replacers has given promising results.

a) Bakery Products : Reduction of the fat content of bakery products is a crucial phenomenon in terms of rheology. However, available reports have suggested that starch hydrolytic products can be used as fat replacers without impairing quality and texture of such products (Anon, 1996). Further, a product available as N-Lite B, prepared by starch hydrolysis, is reported to be used in low fat bakery products without affecting the rheological properties of the dough. Touma (1997) has also reported the manufacture of low fat cakes with overall acceptable quality by using starch hydrolysates.

b) Dairy Products : Interest in low fat foods continues to rise, as consumers become more aware of health, diet and disease. Recognizing this trend, emphasis has also been given for the manufacture of low fat dairy products.

Wheelock (1994) reported a new milk type product, Halo, which was developed by Northern Dairies, UK in response to the demand by consumers for low fat milk type product, using starch hydrolysate based fat replacer, with a more acceptable flavour and texture than semi-skim milk.

Doreau (1994) reported that yoghurt prepared with speciality modified starches derived from waxy maize or tapioca, showed improved texture, viscosity and shelf-life of both stirred and set yoghurts. Apart from fat replacing property, these products also imparted high levels of smoothness, mouthfeel and creaminess. Barrantes *et al.*, (1994) also reported, yoghurt- type products containing starch hydrolysate which exhibited excellent stability without change in acidity and by masking the acidic mouthfeel. Further, they found that hydrolysate in product, improved rheological properties, viz., increased consistency, firmness and decreased syneresis.

Batz *et al.*, (1994) prepared a high moisture (50%), low-fat cheese product by mixing skimmed milk curd, starch hydrolysate, salt and an emulsifier.

In addition to fat substitution, starch hydrolysates have been reported to increase the spreadability of milk solid-based spreads and also used for micro-encapsulation of milk fat (Onwulata *et al.*, 1994). In one study, a blend of hydrogenated fat and liquid oil was used for the preparation of low fat butter spreads. When the fat content of the spread was reduced to 57 per cent by incorporating starch hydrolysate along with hardened oil, the spread showed better spreadability at refrigeration temperature and better stand up properties at high storage temperature as that of commercial butter (Reddy *et al.*, 1999). Moreover, the use of starch hydrolysates in margarine spreads was also reported.

According to some reports, low DE starch hydrolytic products contribute fat-like property enormously to achieve the sensorial properties in low fat product, while retaining the required appearance and consistency (Dorp and Vom, 1991; Specter

and Setser, 1994; Wang and Dorp, 1999). In one report Dorp (1996) suggested the suitability of potato starch hydrolysate with DE (2-5) in ice cream as body and viscosity enhancing agent, stabilizer and fat substitute when added at 3.5% level without any impairment in taste of the product. A marshmallow made with a 10 DE hydrolysate for variegating ice cream retained a marshmallow consistency and texture after freezing and thawing (Murray and Luft, 1973).

The above mentioned applications of starch hydrolysates enlighten the future prospects of use of speciality starch derivatives as fat substitutes.

The joint FAO/WHO Expert Committee on Food Additives (1982) has confirmed the acceptable daily intake (ADI) of the modified food starches as "not specified" and recommended starch derivatives as food stabilizer.

Regulatory Status

The joint FAO/WHO Expert Committee on Food Additives (1982) has confirmed the acceptable daily intake (ADI) of the modified food starches as "not specified" and recommended starch derivatives as food stabilizer (Tamine and Robinson, 1999). Similarly, Life Sciences Research Office, Federation of American Societies for Experimental Biology (1979) commissioned by the FDA has provided the assurances of the safety of modified food starches. Moreover, the usage of modified food starches in foods for infants and young children by a subcommittee of the National Academy of Sciences (1971) and by a Committee on Nutrition, American Academy of Paediatrics (1978) have been approved with the exception of hydroxypropylated starches. European Council Directive on Food Additives 79/112/EEC has also labelled hydrolysed cornstarch, enzymatically modified potato starch, polydextrose and blends of modified starches as food additives (Smith, 1995).

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Role of Functional Foods in Diet

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The readers of this journal SOM- Shaila roup of Industries must have heard about rench Paradox". The French diet is high animal fats and low in fibre but the high cidence of arteriosclerosis and cardiac dis- se which would be expected from such a et is absent. This is attributed to the fact at the French also consume large quanti- s of red wine, rich in natural antioxidants olyphenols which prevent arteriosclero- and hypertension. Soon after this theory ceived media attention in Japan, there was rapid increase in demand for red wine. od manufactures immediately saw an op- rtunity and within months new products ere launched containing - polyphenols m red grapes.

Similar story is for milk chocolates rich polyphenols. This example of utilising lyphenols or extract of grape seed/skins pine bark which is a phytochemical and many time powerful than vitamins C and is just to describe the utility of such func- nal ingredients in creating a "functional od".

According to British Nutrition Founda- n, a dietary ingredient that affects its host a targeted manner so as to exert positive ects (so as to justify a health claim) can be ssified as "functional" ingredient. In other rds, foods containing such ingredients - nctional foods - are foods that have health ing properties over and above their nu- ional value.

The Japanese definition of "functional d" is any food that has a positive impact an individual's health, physical perform- e or state of mind, in addition to its nu- tritive values.

Functional food is basically a food derived from naturally occurring raw materials which is taken as a part of daily diet and has this additional functionality. The functionality can include such things as prevention and recovery from a specific disease, enhancement of immunity, control of physical and mental state and slowing of the aging process.

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Broadly, it can be said that functional foods are one step ahead of healthy natural foods in assisting the therapeutic process of the body towards substitution of medicines.

World market for functional foods has grown by about 60% over the period 1995-2000 and was valued at US $ 50,000 million in 2000.

World market for functional foods has grown by about 60% over the period 1995-2000 and was valued at US $ 50,000 million in 2000.

The aging population, advances in therapeutic knowledge of natural foods and changes in food consumption habits are all believed to contribute to the growth of functional foods industry. As consumers become more aware of the links between diet and health, functional foods are also perceived by many as one answer - a quick fix solution - to unhealthy lifestyles.

The development of the functional foods market is based on several driving forces (Table 1) which are based on the positive contribution of functional foods to improve health in contrast to conventional foods to maintain health.

Table 1. Driving Forces

Demand for

- Health and longevity.
- Quick/convenient solutions.
- Natural products.
- Preventive measures.

Due to

- Increasing health costs.
- Prevention cure.
- Greying population
- Encouraging self-health maintenance.
- Consumer health awareness and choice.

They are largely based on the link "Diet-health" and should fit the basic needs of the modern elite consumer for enduring health in a convenient and natural way.

Reduction of health costs has actively engaged the Japanese government as a contributor to the development of the functional

foods market. However, western countries are still lagging behind. European consumer is now becoming increasingly aware of the link between diet and health.

Health benefits attributed to functional foods are dependent on active or functional ingredients incorporated in them. Functional ingredients are available abundantly in natural foods such as vegetables, fruits, cereals, nuts, milk and milk-based products.

Functional ingredients are available abundantly in natural foods such as vegetables, fruits, cereals, nuts, milk and milk-based products.

Some of the ingredients, which make a food product as functional are as follows:

Dietary fibres; vitamins; minerals; anti-oxidants; oligosaccharides; essential fatty acids (incuding omega-3); flavonoids; phytochemicals; lactic acid bacteria cultures and lignins.

Although, these functional ingredients are available in natural foods, our processing which is aimed at improving the "taste", transforms these natural foods into "junk foods" devoid in their active functional ingredients or sometimes, in additional make the processed food loaded with "toxins" which negatively affect the body metabolism. For example, any deep-fried food, whether a burger, *puri* or *paratha, namkeen* or sweets are loaded with toxins in the form of oxidised fatty acids as well as trans fatty acids besides being high in calories. These trans fatty acids are the transformed products developed by repeatedly heating the oil or ghee at frying temperature.

Theoretically, a functional food has to be 100% natural i.e., free from any additives such as synthetic colour or flavour or any type of preservative.

Another example is grinding of wheat where most of its fibres, vitamins and minerals are lost in making a fine *atta*. So many natural foods supplied by our nature qualify for functional food category, provided these have been processed minimally. For example, while extracting the juice, it becomes functional. Alternatively, natural juice with added fibres or anti-oxidant vitamins or calcium also qualify for this category.

Theoretically, a functional food has to be 100% natural i.e., free from any additives such as synthetic colour or flavour or any type of preservative. The safety of many synthetic colours or flavours may not be doubtful from FDA point of view but these synthetic ingredients also act as toxins inside the body and their regular use may cause more harms than product without these.

The modern concept of processing functional foods is to select the basic raw material from nature after going through the peer reviewed research findings and convert the natural foods into processed foods keeping all active ingredients intact or even enhancing the quality of these functional ingredients while removing the toxins or unhealthy constituents. For example, soyabeans are processed in such a way as to remove its weaning odour and taste without losing its quality of proteins, fibres, essential sample of fatty acids, vitamins and also isoflavones. A soya flour, extracted or defatted by solvent and subsequently dried and crushed is difficult to get qualified as functional food.

Another concept of processing a functional food is to combine some of the functional ingredients in a suitable base or bulk ingredient, which is also functional. For example, processing of milk puddings with skimmed/double toned milk combined fibres, fructose, soya powder and nuts/dried fruits. Many such preparations have already been developed by *"som santi"* while utilising high functional ingredients keeping the nutritional density high and calorific density of food low.

All functional foods have a common denominator; i.e., they affect beneficially one or more target functions in the body and the beneficial effect can be expected when they are consumed as part of a normal food habit.

Optimum Nutrition

As nutrition science is moving from the concept of "adequate nutrition" to "optimal nutrition", new food products which have the potential to improve mental and physical well being and which may also reduce the risk of disease, are being developed.

As a science-based approach is essential, key partners form Europe's scientific community, governmental bodies and the food and agriculture industry have created a platform to establish the fundamental concepts for these functional foods.

All functional foods have a common denominator; i.e., they affect beneficially one or more target functions in the body and the beneficial effect can be expected when they are consumed as part of a normal food habit.

While European consumer is just becoming used to such innovative foods, in Japan, people have been choosing them for decades and in so doing, they have marched towards optimum nutrition and taken preventive health into their own hands.

Legislation

Although functional foods may indeed play such important roles, it is crucial that their manufacturers are not allowed to make claims based on hearsay. In an attempt to ensure this, the United Nation's FAO/WHO, Codex Alimentarius, the Council of Europe and National Regulators are drafting codes, allowing only "well founded and justifiable claims" to be made.

Under these codes, any health promoting claim on packaging must not be misleading and must be based on sound science.

It should be clearly shown that by eating the food in normal quantities, it has physiological beneficial function such as lowering blood pressure or that a positive effect on a biochemical marker, such as, cholesterol which can be measured. Examples of functional food innovation are listed in Table 2.

Although functional foods may indeed play such important roles, it is crucial that their manufacturers are not allowed to make claims based on hearsay.

However, Japan was the first country to introduce an approval system enabling health claims to be made on specified functional products. Health claims may not be

Table 2. Examples of Functional Food Innovations

Food	Functional Benefit
Live fermented milk and yoghurts with probiotic cultures	Improve digestive functioning.
Margarine, yoghurt, cheese spreads	Plant sterols and stanols reduce cholesterol and lower the risk of heart disease.
Eggs rich in omega-3 essential fatty acids	3-4 eggs a week would provide the same amount of n-3 fatty acids as recommended to help reduce the risk of heart disease.
Breakfast cereals	Added folic acid may help reduce the risk of babies being born with spina bifida.
Bread, muesli style bars	Added isoflavones may help reduce the risk of breast and prostate cancers, heart disease and osteoporosis.

ade on food and beverages without approval. The approval system, known in English as the FOSHU system (Food for Specified Health Use) was established in 1991.

In order to obtain approval, the applicant ust prove that the health claim is valid.

The approval claims include the following:

Oligosaccharides : These promote the owth of betfides bacterias in the intestines;

Dietary fibres : These regulate the intestines ad moderate sugar absorption;

Inulin : It acts as soluble fibres and enances calcium absorption;

Table 3. Some Roles and Functions of Omega-3 Fatty Acids in Humans

- Neutral development
- Involvement in blood clotting
- Anticarcinogenic
- Decrease cholesterol level
- Slimming aid
- Membrane functioning
- Plasma TG clearing
- Inflammatory response
- Decrease arteriosclerosis

Soya proteins : These inhibit cholesterol uptake;

Some of the benefits of omega-3 fatty acids are given in Table 3.

Conclusion

Processing and manufacture of functional foods is hi-tech area for the future. Developed countries have already started moving in this direction as consumers are more health conscious there. Food technologists should adopt this category of food for conducting research in coming years and the one who takes the lead will be a sure winner in future.

Solvent Process : A Useful Tool for Rice Bran Oil Extraction

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bstract

The position of edible oil availability in our ountry has been deteriorating day-by-day. Edle oil production from conventional oil seed rops is not sufficient to meet out the demand for ncreasing population of the country. So there is continuous search to look for new and easily vailable source of edible oil. Rice bran is a good nd cheap source of edible oil and it is easily availble in the entire paddy growing areas of the coun-y. It is a by-product of rice milling industry nd is released at the time of polishing operation uring milling of paddy.

About 7-8% of rice bran is available from addy milled. Bran from raw paddy contains 15-8% oil, while 22-25% oil can be extracted from ran of par-boiled paddy. The rice bran obtained rom rice mills contains huge amount of husk paricles, broken rice, sands and fines. It is necesary to clean it well before subjecting to oil exraction. The bran oil also has various types of ndesired chemical impurities viz 50-55% FFA, .0-2.0% gums, 2.0-2.1% waxes, 2.1-2.2% sterls and 1.5-1.6% dirts. These should be removed y specific processes to get edible grade oil.

ntroduction

Edible oil production from conventional il seed crops, like mustard, sesamum, groundnut, cotton seed and sunflower etc., s not sufficient to meet the demand of inreasing population of our country. So there s a need to look for new and cheap sources f edible oil. Rice bran is a good and cheap ource of edible oil. It is produced at the time f polishing operation during rice milling system. Rice bran is about 7-8% of paddy milled. About 15-18% of oil can be extracted from the rice bran available from milling of raw paddy and 22-25% oil can be extracted from the rice bran available by milling of parboiled paddy. (Yokochi, 1977)

Paddy is the major cereal crop of our country. Next to China, India is the second largest producer of rice in the world. It is estimated that about 130 million tonnes of paddy was produced in our country during 2000-01. If it were milled properly, it would release about 10.384 million tonnes of rice bran that may produce about 1.558 million tonnes of crude bran oil. After proper refining it would give 1.402 million tonnes of edible grade rice bran oil that is ready for human consumption. (Sheth, 1982)

About 15-18% of oil can be extracted from the rice bran available from milling of raw paddy and 22-25% oil can be extracted from the rice bran available by milling of parboiled paddy.

Methodology

Rice bran contains an oil-dissociating enzyme called Lipase. It is present in dormant state in paddy grain and becomes active in rice bran as soon as it is removed during polishing of rice. It converts edible oil into free fatty acids (FFA) and glycerol that not only reduces the quantity of bran oil but also changes the taste bitter and makes it non-consumable for human beings. It is observed that FFA increases by 1.0-1.2% per hour just after polishing. The bran oil normally contains about 5-6% FFA, which has to be refined to get edible grade oil. Therefore, enormous work has to be done in the country for stabilization of rice bran just after milling and before the oil extraction process to get higher amount of edible oil from rice bran. (Azeenoddin and Thiramala Rao, 1978)

The expeller operation does not recover oil from rice bran efficiently as the bran is fluffiest in nature and so release only small percentage of oil. Thus the solvent extraction process is the most suitable technique for extracting higher amount of oil from rice bran. (Rao, 1978)

Food grade hexane is used as the solvent agent for the extraction of bran oil. The solvent extraction may be carried out by batch extraction process or by continuous extraction process. For obtaining high quality edible oil, the bran having low content of FFA (less than 5%) must be freshed and well stabilized. It should also have less than 5% of different impurities *viz* particles of husk, stone, sand and dust. (Sheth, 1982)

Pillaiyar (1977) explained different types of rice bran stabilization processes as listed below:

A) Indirect heating processes : i) Sun drying of bran; ii) Drying with steam; iii) Cold storage keeping and

B) Direct heating processes : i) Screw conveyor stabilizer; ii) Rotary type stabilizer; iii)

Fluidized bed stabilizer; iv) Pelleter cum stabilizer; v) Infrared radiation stabilizer; vi) Steam heated stabilizer and vii) Chemical bran stabilizer.

Solvent Extraction Process

It has following operations described below:

a) Pre-treatment of Rice Bran

i) Cleaning of Bran

The rice bran samples obtained from different rice mills contain particles of broken rice, husk, sand and dust. It is necessary to remove all these impurities before subjecting to oil extraction. The bran is passed over a vibratory screen, gravity separator and destoner in a sequence for separation of all these unwanted refractions.

ii) Cooking and Conditioning

As rice bran is powdery and fluffy in nature, oil extraction with the help of different chemical solvents possess a problem. The fine particles of bran offer resistance to extraction and cause desolventisation of the meal and contamination of oil with fines. Therefore, rice bran particles should be made to conglomerate into larger and heavier particles before extraction. These are called rice bran pellets. This can be done by any of the following methods : (Sheth,1982).

a) Rice bran may be cooked with steam and dried by evaporative cooling system resulting in increase of particle size. The process is known as crisping and imparts better oil extractability through easy percolation of the solvent (Azeenodin and Thiramala Rao, 1978).

b) Rice bran may be cooked and passed through a mechanical screw press resulting into bran pellets of heavier and bigger shape. The process of expressing and releasing larger bran particles is called expansion.

c) Rice bran is cooked with steam for a definite time at a particular temperature and then palletized. The pellets should be allowed to dry to keep intact during extraction. (Rao, 1978).

b) Rice Bran Oil Extraction

The rice bran pellets enter into the structure through sealing bin, which prevents any hexane solvent vapours finding their way into the preparatory section through the feed conveyor. It has following steps:

i) Solvent Flow Operation

There are two types of extraction units being used in the country i.e., batch type process and continuous type process. Among the batch oil extractors, the most popular type is that of solvent extractor which is a jacketed batch extractor. The extraction and desolventisation are carried out in the same vessel. Vacuum is created during the desolventisation. Among the continuous type extractors, the most favoured is the horizontal moving bed (De Smet type) working on counter-flow of solvent. The extraction system allows the extraction of oil by percolation of solvent through the meal bed (Rao, 1978).

There are two types of extraction units being used in the country i.e., batch type process and continuous type process.

ii) De-Solventisation Operation

In the case of jacketed type batch extractor, the desolventisation is carried out in the vessel itself under vacuum conditions. But in continuous type extractor, the desolventisation is done separately in drier types, which are placed horizontally. These tubes consist of steam-jacked cylinders fitted with a series of rotating blades to remove the solvent traces from the de-oiled meal.

iii) Distillation Operation

The solvent is recovered from the miscella in two stages namely evaporation and stripping. The evaporation used is either of falling film type or of rising film type. It is important to maintain a vacuum in the evaporator in order to get high quality oil and saving in steam consumption by way of cutting short the residence time of the miscella in the evaporator. The solvent remaining in the oil after passing through the unit should not exceed 4-6%.

The last traces of the solvent are removed in the stripping section. The modern trend is to replace the steam stripping by flash evaporation under high vacuum. In this method, the phosphatides present in the miscella are in the dissolved state and can be separated out from the final oil content if no open steam is given in sizeable quantity. It is then possible to get clean oil.

iv) Vapour Recovery Operation

The earlier used refrigeration system for the solvent vapour recovery is now replaced by oil absorption system that has eliminated the high processing and maintenance cost of ammonia-scaled compressor. The vegetable oil extracted in this process has been employed as the absorption medium.

The crude rice bran oil is refined to make edible grade oil with the help of following refining processes, such as esterification, alkali refining solvent refining, molecular distillation and physical refining.

c) Oil Refining Process

The crude rice bran oil is refined to make edible grade oil with the help of following refining processes, such as esterification, al-

Table 1. Area, Production and Yield of Paddy in India

Year	Cropped Area (million ha.)	Average Yield (kgs/ ha.)	Production (million tonnes)
1946-47	28.12	903	28.18
1950-51	30.81	1002	30.87
1955-56	31.52	1311	41.44
1960-61	34.13	1519	51.85
1965-66	35.47	1617	55.96
1970-71	37.59	1684	63.33
1975-76	39.47	1852	73.11
1980-81	39.77	1942	79.84
1985-86	41.50	2082	92.42
1990-91	43.88	2188	113.35
1995-96	45.73	2205	123.30
2000-01	46.20	2230	129.80

Source : *Rice Production Report, Min. of Food and Agriculture. (GOI), New Delhi.*

Table 2. Rice Bran Available, Crude Bran Oil and Bran Refined Oil in India

Year	Bran Available (million tonnes)	Crude Bran Oil (million tonnes)	Bran Refined Oil (million tonnes)
1946-47	2.254	0.338	0.304
1950-51	2.470	0.371	0.334
1955-56	3.315	0.497	0.448
1960-61	4.148	0.622	0.560
1965-66	4.477	0.672	0.605
1970-71	5.166	0.775	0.700
1975-76	5.849	0.877	0.798
1980-81	6.387	0.958	0.862
1985-86	7.394	1.109	0.998
1990-91	9.068	1.360	1.224
1995-96	9.864	1.480	1.332
2000-01	10.384	1.558	1.402

Source : *Rice Production Report, Solvent Extractors Association of India.*

Table 3. Nutritional Costituents of Rice Bran and Rice Bran Oil

Constituent	Rice Bran (%)	Rice Bran Oil (%)
Moisture	10.64	1.20
Protein	14.04	18.50
Fat	18.20	77.80
Cellulose	12.30	--
Reducing sugar	2.30	2.30
Ash content	10.90	0.20

Source : *Pandey & Gupta (1995): Jr. of Food Tech. CFTRI, Mysore*

Table 4. Chemical Composition of Crude and Refined Bran Oil

Parameter	Optimum Value (%)	
	Crude Bran Oil	Refined Bran Oil
Free fatty acids	50-55	0.35-0.55
Waxes	2.0-2.5	0.02-0.03
Gums	2.0-2.6	0.020-0.022
Sterols	2.0-2.5	0.021-0.022
Resins	0.5-0.6	0.005-0.006
Solid impurities	1.0-1.2	0.015-0.016
Unsaponificable matter	5.5-6.0	0.051-0.055
Other insolubles	2.0-2.2	0.020-0.021
Moisture content	1.2-1.5	0.90-0.95

Source : *Chemical Composition of Bran Oil (1988): A Technical Report of CFTRI, Mysore*

Table 5. Physical and Chemical Properties of Rice Bran Oil

Parameter	Optimum Value
Specific gravity at 30°C	0.91-0.92
Refractive index at 40°C	1.46-1.47
Insoluble impurities	0.10%
Saponification value	180-195
Iodine oil	90-105
Acid value	0.5
Free fatty acids	0.25%
Flash point	250°C
Unsaponifiable matter	2.5%
Wax content	4.8%
Colour	Greenish blue
Odour	Light pungent
Solubility in water	0.2%

Source : *Kirschan Banner H G (1989): A Technical Report on Chemistry of Fats & Oils.*

Table 6. Fatty Acid Composition of Rice Bran Oil

Parameter	Optimum Value (%)
Saturated fatty acid	15.20
Unsaturated fatty acid	80-85
Oleic acid	40-50
Linoleic acid	29-42
Palmatic acid	12-18
Linolenic acid	0.8-1.0
Mysristic acid	0.4-1.0
Stacric acid	1.0-3.0
Palmitic acid	0.2-0.4

Source : *Jamisson (1986): Jr. of Oils and Fats Industries, No.3*

kali refining solvent refining, molecular distillation and physical refining.

i) Esterification

The crude bran oil containing high amount of free fatty acid involves its treatment with glycerol in presence of a suitable catalyst such as paratoluene, sulphonic acid, zinc chloride or stannous chloride etc. Thus the heating of rice bran oil having FFA of about 38-40% and glycerol of 5% with stannous chloride of 2% by weight of oil at a temperature of 250°C reduces the FFA to about 4%. The oil so obtained can be further processed and purified for human consumption. The oil containing FFA below 5% is most suitable for human consumption.

ii) Alkali Refining

It is the most commonly used method for refining oils and fats in our country. However, because of the very high losses, it is not economical to use for bran oil having FFA more than 20%.

iii) Solvent Refining

In this method the advantage of difference in specific gravities of various type of oils and fats is utilized. The high acid oil is heated with a solvent. The FFA passes on to the solvent phase. The solvents mostly used are agneous acetone (3%) and methanol (4%).

iv) Molecular Distillation

The undesired components of bran oil can be separated out by molecular distillation conducted at a pressure of 3-30 mm of mercury that is very high as compared to pressure of merely 1-3 mm of mercury in case of conventional physical refining.

v) Physical Refining

It has steam de-acidification process, which involves the steam distillation of pretreated high acid bran oil. The free fatty acid and odourous materials are thus distillated off and low FFA oil is left in the still. Thus, treating of one tonne of crude bran oil (having 55% FFA, 2% gums, 2% waxes, 2.5% sterols and 1.5% dirt) releases 0.37 tonne of refined oil (having 0.55% FFA, 0.02% gums, 0.02% waxes, 0.022% sterols and 0.015% dirt), containing lesser impurities.

d) Purification of Bran Oil

After removing soluble impurities from rice bran oil during various refining processes, it has to be further purified for removing even fine soluble and suspended matter like gums, waxes, phosphatides etc., as described below:

i) Winterization Process

This process is used for removal of waxes. During the process, the oil is cooled to a low temperature of 8-10°C to crystallize the high melting waxes. Settling processes like decantation, filtration, centrifugation etc. can separate these waxes out. The waxes can also be removed by combining processes (winteri-zation with miscella refining) using hexane and isopropyl alcohol as solvents.

ii) De-gumming Process

It is used for the removal of gums and phosphatides. The bran oil, after de-waxing, is mixed with phosphoric acid (0.2-0.3% by weight of oil). This causes the hydration of gums and phosphatides and makes them insoluble in oil and thus precipitate out. These insoluble matters can also be removed by settling, filtration, centrifuging or by alkali neutralization along with the removal of FFA.

iii) Alkali Neutralization

Edible grade bran oil contains 5-7% FFA. These free fatty acids can be removed by neutralisation with caustic soda and then refining further by physical process applying either batch type or continuous type refining.

iv) Bleaching

It is used to remove coloured pigments. The oil is bleached using good quality filter's earth with low free acidity. The charge is heated to 115°C under good vacuum conditions and bleached earth is stocked in the form of slurry with bleaching time of 30-40 minutes. The oil is cooled to 70-80°C before filtering. During bleaching, primary oxidation products (peroxides) are converted into secondary oxidation compounds, which are absorbed on the activated earth lead to purification of oil.

v) De-odourisation

It is necessary to remove the disagreeable flavours and odours, which are present in the oil. Following inter-related conditions are essential during the de-odourisation. (a) High temperature of de-odourisation (250-260°C); (b) Minimum absolute pressure (2-3 mm of mercury); (c) Sufficient stripping steam; and (d) Efficient agitation of oil.

By heating at high temperature the odourants vapourise leaving behind the odour free oil mass.

vi) Hydrogenation

The hydrogenation of rice bran oil is done to get white crystalline pure edible grade bran oil in semi-solid form. Gas circulation system is widely used in vanaspati industry. Various catalysts like palladium, platinum, copper, chromium oxide, copper chromate and nickel are available for hydrogenation of vegetable oils. Nickel is the best and cheapest catalyst which gives most selective hydrogenation in view of the fact that linolenic acid is hydrogenated in preference to linolic acid which in-turn is hydrogenated in preference to oleic acid.

Safety Measures

There is a strong need for safety in running a hazardous prone solvent extractions plants having highly inflammable compounds like hexane. Bran oil is also a highly fire catching liquid. Following measures should be adopted for proper safety of the unit:

- The solvent plant should be located away from urban areas preferably 4-5 kilometers away from outer periphery and 16-20 meters away from the residential areas.
- It should be provided with vapour barrier wall of 1.2-1.5 meter height with a perimeter of 15-16 meter all around having no opening.
- All the buildings facing the solvents should have windows at least at the height of 1.5 meter from the ground.
- All the effluents from the plant should pass through a solvent trap where any inadvertent flood of solvent could be tapped.
- The solvent plants should be provided an emergency strong tank. In the event of power failure, the water from the tank would flood the condensers for a period of about 20 minutes till all the residual vapours are condensed.
- The main steamline entering the plant should be fitted with a solenoid controlled valve. When the power is switched off, the valve automatically closes, thus cutting off steam flow to the plant.
- The vapour vent line to the absorption system should be fitted with a thermostat, set at a specific temperature. In the event of temperature rise of vent vapours, it should automatically start the alarm system.
- All the tools and instruments should be spark proof. The workers should not wear synthetic fibre dresses and should not carry radios, candles, match boxes, cigarettes etc.
- No hammering, cutting and welding operations should be done within the plant without complete desolventization of the plant.
- The fire fighting appliances, fire brigades and fire extinguishers should be kept ready all the time for any emergency.

Area, production and yield of paddy in India/availability of crude and refined bran oil/nutritional constituents rice bran and rice bran oil/chemical composition of crude and refined bran oil/physical and chemical properties of rice bran oil/fatty acid composition of rice bran oil are given in Tables 1-6 respectively.

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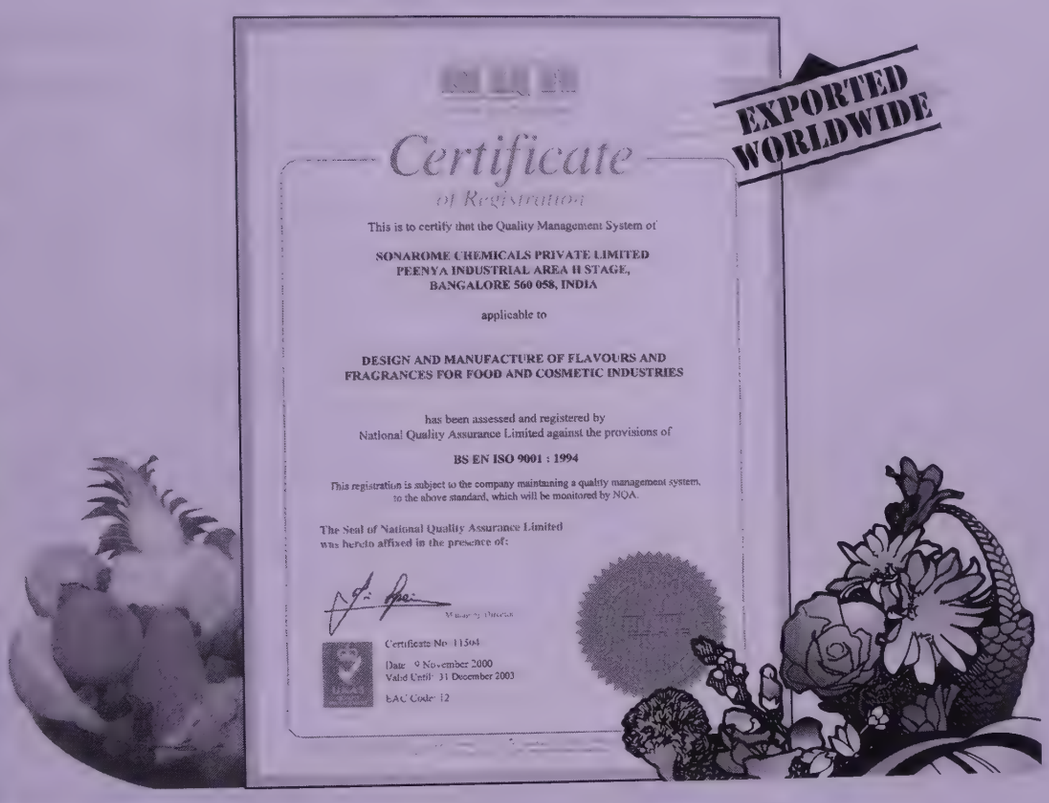

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EVENTS

GLOBAL FOOD TEC 2002

The 2nd Premier Indian International Exhibition and Conference for F & B and Processed Food Industry will be held from October 10-13, 2002 at Bandra Kurla Complex, Mumbai

The Objectives of the exhibition are

- Identify modern market trends
- Strategy for developing brand loyalty.
- Creating institutional image.
- Opportunity to explore the new market.
- Product improvement for instant feedback from customer.
- Developing business and market
- Best way to complement to your advertisement efforts.
- Best forum for technology transfer, investment and joint venture.
- Locate new distributors / dealers.
- Network with all the players in the food industry.
- Unique opportunity to place product, concepts, ideas, technology on single platform.
- Highlight the latest development in the field of food beverages, agro and processed food industry.
- To understand and anticipate the challenges of new millennium.
- Identify modern food trends.

Exhibitions' Profile Covers

Processed foods; dairy products; beverages; breweries and wine; fresh frozen foods; ice cream and desserts; seafood; confectionery; spices; bakery products; canned foods; food processing : machinery and equipment; agriculture: supplies and equipment; packaging material: machinery and equipment; dairy machinery and equipment; canteen equipment; beverage and softdrink; wrapping machinery; waste/water treatment; measurement and weighing; automation; printing and packaging; labeling and marking; canning technology; food ingredients/additives; storage system; refrigeration and freezing equipments; bottling technology; instrumentation; testing and quality control; liquid handling; process control and technology; herbal medicine; software for process/plant; commercial catering.

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E-mail : gft2002@indiatimes.com
globalexhibition@yahoo.com
Website : www.eglobalfoundation.org

AGRI INTEX - 2002

The 3rd Agricultural International Exhibition- AGRI INTEX 2002 - will be held from August 1-6, 2002 at Codissia Trade Fair Complex, GV Fair Grounds, Avinashi Road, Coimbatore 641 014.

The objectives of AGRI INTEX - 2002 are:

- To exploit the natural resource potential to improve the quality of life in rural areas through employment and foreign exchange earnings.
- To help value addition to produce and service and create marketing facilities.
- To extend all logistic support to agriculture and industry for growing at par to global standards.
- To enlighten the agricultural sector to adapt themselves to meet the challenges of fast changing local and global markets.
- To develop the positive attitude of farming community for judicious use of natural resources like land, water and climate to their advantage.
- To sow seeds to make the average farmer to be more innovative, the innovative farmer to be more progressive, and the progressive farmer to be more aggressive.

The Display Profile Covers

Recent developments in the field of agriculture, horticulture, wasteland development, agro industries, biotechnology, floriculture, plantation crops, sericulture, green house, tissue culture, transgenics and seed production, bioproducts, organic farming, agro forestry, water management, drip and sprinkler irrigation, post-harvest technology, processed foods/oils/beverages/value addition, herbal, medicinal plants and products, non-conventional energy, cold storage, mushroom, integrated farming, gasohol, fertilisers and pesticides, poultry and dairy, animal husbandry, aquaculture, agri finance and marketing, agri educational and research, renewable energy.

For details contact:

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Chairman
AGRI INTEX - 2002
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GV Fair Grounds, Avinashi Road
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Phone : 91-422-593505; 593507
Fax : 91-422-593506
E-mail : cointec@vsnl.com
Website : industrialtradefair.com
www.agriintex.com

EFFI-INDIA 2002
Food Alliance India

EEFI India 2002 is India's first international exhibition focussing on the food ingredient and additives industry. The present trade fair is being held from November 15-18, 2002 at Mumbai

Exhibitors from Australia, Belgium, China, Denmark, France, Germany, Italy, Japan, Netherlands, Spain, USA, UK etc., are expected to take part in the exhibition.

For further details:

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E-mail : effindia.vsnl.net
Website : www.effindia.com

AGRIFARE 2002

The Confederation of Indian Industry (CII) Gujarat office is organising the second AgriFare 2002 at Ahmedabad from October 24-27, 2002.

AgriFare 2002 aims to bring together technology and direct investment to accelerate development of agriculture and food processing industry through equity investment, joint venture arrangements, strategic alliances, technology, tie-ups, buyback arrangements and relevant commercial linkages. The AgriFare 2002 hosts three events concurrently in an effort to comprehensively capture the food and agro potential, *viz.*, The AgriFare Exhibition, The AgriFare Investment Meet and The AgriFare Conference.

AgriFare 2002 will focus on following sectors:

Oil and oilseeds; floriculture; sericulture; aquaculture; hydroponics; biotechnology; tissue culture; hybrid seeds and grains; social forestry; green house technology; agro chemicals; fertilizers;

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AFSTI(I) NEWS

AFSTI (I) Awards for Year 2000

The following distinguished persons were honoured with various awards instituted by AFST(I) at a simple function held at the New Auditorium, UDCT, Mumbai on December 19, 2001.

Prof. V Subrahmanyan Industrial Achievement Award 2000

Shri. M R Chandrasekhara, M.Sc., received the Prof. V Subrahmanyan Industrial Achievement Award for the year 2000. Shri Chandrasekhara is a wellknown dairy technologist who was the key figure at CFTRI in indigenous development of an infant food, based on buffalo milk, which was commercially exploited by the Kaira District Cooperative Milk Producers' Union (KCMPU) at Anand, Gujarat. This was branded as Amul Baby Food and marketed successfully throughout our country.

Shri. M R Chandrasekhara was also instrumental in developing a weaning food branded BAL AMUL which was also produced and marketed by KCMPU. He was also responsible for developing the first toned milk called MILTONE and setup a manufacturing plant at Bangalore Dairy under the aegis of UNICEF. This product is being distributed to schools and other child feeding centres all over Bangalore for the benefits of school children, expectant and nursing mothers.

In recognition of these contributions Shri. M R Chandrasekhara was honoured with the Prof. V Subrahmanyan Industrial Achievement Award 2000 by the Association of Food Scientists and Technologists (India).

Laljee Godhoo Smarak Nidhi Award 2000

Dr. M S Thakur, M.Sc., Ph.D., a senior scientist at CFTRI was honoured with the Laljee Godhoo Smarak Nidhi Award for the year 2000. Dr Thakur has been actively engaged in research on biosensors. He has worked on several projects involving Biosensor Research founded by CFTRI, DST, DBT, Indo-Swedish and Indo-Swiss collaboration studies. A biosensor for L-lactate detection developed by his group has been transferred to industry. His research work has so far focussed on development of immobilized enzyme-based biosensors for sugars, organic acids and pesticides and more recently, on immune-bioreactor based biosensor for organophosphorus pesticide residues in food and environment. Presently, he is engaged in developing Flow Injection Analysis (FIA) systems, useful for continuous monitoring and control of food and fermentation processes.

He is a life member of AFST(I) and Society of Biological Chemists, India. He is founder president of Biosensor Society of India.

In recognition of his significant contributions Dr. Thakur was honoured with Laljee Godhoo Smarak Nidhi Award for the year 2000.

Fellow AFST(I) Award

Dr. D R Bongirwar, Head, Food Technology Division and Project Manager, Food Irradiation Project at BARC, Mumbai was honoured with the title "Fellow of AFST(I) for the year 2000". Dr Bongirwar has made significant contribution in the areas of radiation, preservation of foods and design, construction and installation of radiation processing facilities, allied workshop machinery and food processing equipment. Besides designing and developing processes for food preservation like osmotic drying, freeze drying, defatting of peanuts/soybean, solar drying technique for farmers and traders, he is vigorously pursuing programmes for consumer acceptance of radiation - processed foods within the country. He has been chiefly responsible for installation of India's first radiation processing facility for processing foods at the Bhabha Atomic Research Centre, Mumbai. He is also instrumental for design, construction, installation and commissioning of the country's first ever demonstration facility POTON for processing of potato, onion and other low dose products Lasalgaon in Maharashtra.

In recognition of his significant contributions in the area of radiation preservation with special reference to design, construction and installation of radiation processing facilities, the Association of Food Scientists and Technologists (India) conferred on Dr. D R Bongirwar the Fellow of AFST(I) Award for the year 2000.

Fellow AFST(I) Award

Shri. K C De has made significant contribution in the development of the processed food industry in India through his position as Research Manager at the Metax Box (India) where he was mainly responsible for the development of various packaging materials some of which were import-substituted. He was also responsible in organising and managing a countrywide extension service to processed food manufacturers.

Shri. De has contributed to the development of the processed food industry in India through his active participation in meetings of ISI committees and the Processed Food Export Promotion Council. He has participated in many conferences and presented papers. He continues to give lectures to participants undergoing training courses on food packaging at the Indian Institute of Packaging. Many articles authored by him have been published in the Indian Food Packer and other reputed journals. He is a life member of AFST(I). He has been active in All India Food Preservers' Association since the 1960s.

In recognition of his significant contributions in the area of food packaging with special reference to cans and canning technology, the Association of Food Scientists and Technologists (India) conferred on Shri. K C De the Fellow of the Association Award for the year 2000.

Young Scientist Award 2000

Shri. N K Rastogi, B.Sc., B. Tech, MBA was honoured with the Young Scientist Award for the year 2000. Shri. Rastogi worked on several aspects of high hydrostatic pressure, high electrical field pulses and the combined effect of these pre-treatments on osmotic dehydration. His studies demonstrated that high pressure pre-treatment could reduce leaching losses of nutrients during rehydration of foods.

At CFTRI, he has developed a process for the detachment of coconut kernel from its shell; for the production of spray dried coconut milk powder, instant mango fruit powder, honey powder and sugarcane juice powder. His other R & D work includes membrane processing of mango pulp, application of IR radiation for detachment of cashew kernel, hurdle technology for food preservation and non-thermal processing. He is a faculty member in the area of Food Engineering for PG courses of Mysore University.

In recognition of his significant contribution in the area of Process Engineering and Food Technology, Shri. Rastogi was honoured with Young Scientist Award, by the AFST(I), for the year 2000.

Best Student Award 2000

Shri. Devaraj Dabas, B.Tech., Dairy Technology, was honoured with the Best Student Award for the year 2000 by the Association of Food Scientists and Technologists (India). Shri. Debas won gold medal and certificate of merit for securing first rank at the NDRI, Deemed University.

He has participated in M.Sc. degree in Food Technology, at CFTRI, Mysore. His investigation topic has been "effects of processing variables and ingredients variation in quality characterization of instant fried noodles".

In recognition of his outstanding academic achievements, AFST(I) honoured Shri Devraj Debas with Best Student Award for the year 2000.

Best R & D Paper Published in the Journal of Food Science and Technology 2000

The paper entitled "Design and Development of Saffron (*Crocus Sativus L.*) Processing Equipment" jointly authored by J K Sama, B L Raina and A K Bhatia of Regional Research Laboratory, Jammu, published in the *Journal of Food & Technology*, Vol. 37, No.4, 2000, pp. 357-362 has been adjudged the "Best R & D Paper" for the year 2000.

Best Feature Article Published in the Indian Food Industry 2000

The feature article entitled "Time Temperature Indicators as Shelf-life Monitors in Food Industry" jointly authored by B V Dharmendra, C Ganesh Kumar and B N Mathur of National Dairy Research Institute, Karnal, published in Vol. 19, No.3, 2000, pp. 181-189 of *Indian Food Industry* has been adjudged the "Best Feature Article" for the year 2000.

Seminar on TOFU in Bhopal

The Bhopal Chapter of Association of Food Scientists and Technologists (India) and the Central Institute of Agricultural Engineering, Bhopal jointly organized a Seminar by Dr. (Ms.) Hea-Ran (Helen) Ashraf, USA on 18th April 2002 at Central Institute of Agricultural Engineering, Bhopal, in collaboration with Winrock International, New Delhi. Dr. Gyanendra Singh, Director, CIAE, Bhopal was the Chief Guest on this occasion and Dr. Nawab Ali, Project Director, Soybean Processing and Utilization Centre and President, AFST(I), Bhopal Chapter, was the Chairman. Dr. S D Kulkarni, Head, Agro Processing Division, CIAE and Honorary Secretary, AFST(I), Bhopal Chapter, welcomed the guests. He also introduced the speaker Dr. (Ms.) Hea-Ran (Helen) Ashraf, USA, who is currently working at Southern Illinois University, Carbondale, Illinois, USA.

In the seminar Dr. Ashraf presented her views on the topic-promotion of TOFU (Soy-Paneer), quality aspects and consumers feedback. In her presentation, she gave background information on uses of soybean for human health and covered various aspects and strategies that can be adopted in educating different sections of the population for getting the benefits of the soybean. She indicated that the TOFU needs to be attended on top priority for maintaining its quality. Otherwise, it can be a Potential Hazardous Food. She also emphasized the importance of feedback studies in ascertaining the outcome of efforts made in popularizing of soy food for human use. Dr. Ashraf suggested that efforts through different strategies should continue for popularization of soybean for food use. She also stressed the need for microbiological quality assurance of the sensitive products like TOFU and reminded that quality of water plays an important role in giving good quality end product. The importance of HACCP was also stressed for getting quality product.

Dr. Gyanendra Singh, Director, Central Institute of Agricultural Engineering, Bhopal, stressed the need for continuing efforts for popularization of soybean for food uses for the needy population. He indicated that it would take some more time for TOFU to become a common man's product in India. Dr. Nawab Ali, in his address, mentioned that the soybean has good future in India on account of its nutritional and health benefits.

The seminar was attended by about 50 participants from CIAE and AFST(I) members from CIAE, Home Science College and the food industry. Vote of thanks was proposed by Dr. Krishna Jha, Principal Scientist at SPU, CIAE.

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EVENTS

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pesticides; agro services; storage equipment; marketing organisations; financial institutions; nodal government agencies; specialised transport systems; food processing equipment; preservation systems; refrigeration; technology; packaging systems; beverages; processed and frozen foods; edible oil and packaged foods; health foods and herbal products; dairy equipment and technology; dairy management; dairy products; dairy services; poultry equipment and technology; poultry management; poultry products; poultry services; cotton; isabgul (psyllum); spices; horticulture; dairy and animal husbandry; agricultural waste; herbs; tobacco; guargum; fisheries; organic farming; natural extracts; infrastructure development and agro park; farm equipment, implements and tractor manufacturers.

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Inputs are Welcome from Chapters for AFST(I) News Column

Indian Food Industry as flagship of AFST(I) activities takes pleasure in giving coverage to news from various Chapters. Office bearers of AFST(I) Chapters may send write-ups on their activities such as Seminars, Workshops, Meetings and other events for inclusion in the AFST(I) news column. Photographs related to the events are also most welcome. Individual members of AFST(I) may also send brief write-ups on professional achievements such as winning prestigious awards and honours which will be included in the column. It may kindly be noted that these contributions are subject to editing for want of space and relevance.

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